16th INTERNATIONAL CONFERENCE ON MACHINE DESIGN AND PRODUCTION

CONFERENCE PROGRAMME AND BOOK OF ABSTRACTS

umtik 2014

30 June- 3 July, 2014

IZMIR- TURKEY

MATIMAREN
DEPARTMENT OF MECHANICAL ENGINEERING
MIDDLE EAST TECHNICAL UNIVERSITY
ANKARA – TURKEY

This book can be obtained from the following address:

UMTIK
Mechanical Engineering Department
Middle East Technical University
06800 Ankara – TURKIYE

Editorial Assistant:

Bahram Lotfi Sadigh

Cover Print:

METU-Ankara

Printing and Binding:

METU-Ankara

Printed by:

Dereağzı Fotokopi

ISBN 978-975-429-331-9

Organizing Committee

Metin AKKÖK	**(METU, Mechanical Eng. Dept.)**	akkok@metu.edu.tr
Abdülkadir ERDEN	**(Atılım Univ. , Dept. of Mechatronics Eng.)**	erden@metu.edu.tr
S. Engin KILIÇ	**(Atılım Univ. , Mechanical Eng. Dept.)**	engink@metu.edu.tr
E. İlhan KONUKSEVEN	**(METU, Mechanical Eng. Dept.)**	konuk@metu.edu.tr
Ali Oral	**(Balıkesir University, Mechanical Eng. Dept.)**	alioral@balikesir.edu.tr
İbrahim E. SAKLAKOĞLU	**(Ege University, Mechanical Eng. Dept.)**	i.e.saklakoglu@ege.edu.tr

Machining Day Organizing Committee

Erhan Budak	**(Sabancı University, Mechanical Eng. Dept.)**	ebudak@sabanciuniv.edu.tr
İsöail Lazoğlu	**(Koç University, Mechanical Eng. Dept.)**	ilazoglu@ku.edu.tr

Contact : umtik@metu.edu.tr **Tel :** + 90 312 210 2570- 2589- 5242

International Program Committee

Memiş	ACAR	UK
Serpil	ACAR	UK
M. Oktay	ALNIAK	TURKIYE
Ahmet T.	ALPAS	CANADA
Yusuf	ALTINTAŞ	CANADA
Ömer	ANLAĞAN	TURKIYE
Stuart	BARNES	UK
Adil	BAYKASOĞLU	TURKIYE
Necip	CAMUŞCU	TURKIYE
Fuh-Kuo	CHEN	TAIWAN
Tsung Chia	CHEN	TAIWAN
Hugi	CHRISTOPH	SWITZERLAND
Octavian	CIOBANU	ROMANIA
M. Cemal	ÇAKIR	TURKIYE
Can	ÇOĞUN	TURKIYE
Samad	DADVANDIPOUR	HUNGARY
Saied	DARWISH	SAUDI ARABIA
Türkay	DERELİ	TURKIYE
Leo	De VIN	SWEDEN
László	DUDÁS	HUNGARY
Bülent	EKMEKÇİ	TURKIYE
Ferenc	ERDELYI	HUNGARY
Kaan	ERKORKMAZ	CANADA
Hüseyin	FİLİZ	TURKIYE
Necdet	GEREN	TURKIYE
Francesco	JOVANE	ITALY
Yiğit	KARPAT	TURKIYE
Zvi	KATZ	SOUTH AFRICA
Adnan Z.	KILANI	JORDAN
Bozidar	KRIZAN	CROATIA
Bing	LI	P. R. C.
Yangmın	LI	MACAO
Tzuo Liang	LUO	TAIWAN
Yoshiyuki	MATSUOKA	JAPAN
Laszlo	MONOSTORY	HUNGARY
Toshimichi	MORIWAKI	JAPAN
Jokin	MUNOA	SPAIN
Jun	NI	USA
Tuğrul	ÖZEL	USA
Naki	POLAT	TURKIYE
Mustafizur	RAHMAN	SINGAPORE
Can	SAYGIN	USA

Eiji	SHAMOTO	JAPAN
R.	SIVASUBRAMANIAN	INDIA
Daizhong	SU	UK
Ulvi	ŞEKER	TURKIYE
Uğur	ŞIMŞIR	TURKIYE
Erman	TEKKAYA	GERMANY
Tibor	TOTH	HUNGARY
Ali	ÜNÜVAR	TURKIYE
Hakkı Özgür	ÜNVER	TURKIYE
Ivica	VEZA	CROATIA
Min	WAN	P. R. C.

List of Referees

Ahmet Hakan	ARGEŞO	TURKIYE
Kutluk	B. ARIKAN	TURKIYE
Mustafa	BAKKAL	TURKIYE
Besim	BARANOĞLU	TURKIYE
Stuart	BARNES	UNITED KINGDOM
Hakan	ÇALIŞKAN	TURKIYE
Barbaros	ÇETİN	TURKIYE
Ender	CIĞEROĞLU	TURKIYE
Serkan	DAĞ	TURKIYE
Kemal	DAVUT	TURKIYE
Ali Gökhan	DEMİR	TURKIYE
Cem	DÖKMEN	TURKIYE
Merve	ERDAL	TURKIYE
Zuhal	ERDEN	TURKIYE
Seniz	ERTUĞRUL	TURKIYE
Fehmi	ERZİNCANLI	TURKIYE
Volkan	ESAT	TURKIYE
Kemal Efe	ESELLER	TURKIYE
Marcel	FEY	GERMANY
Kemal	İDER	TURKIYE
Celalettin	KARADOĞAN	TURKIYE
Zekai Murat	KILIÇ	TURKIYE
Aylin	KONEZ EROĞLU	TURKIYE
Bahram	LOTFISADIGH	TURKIYE
Cemal	MERAN	TURKIYE
Ömer	MUSIC	TURKIYE
Ahmet	ÖZDEMIR	TURKIYE
Bülent	ÖZER	TURKIYE
Gökhan	ÖZGEN	TURKIYE
M. Kemal	ÖZGÖREN	TURKIYE
Bülent	PLATİN	TURKIYE
Merih	ŞENGONUL	TURKIYE
Tayfun	SIĞIRTMAÇ	TURKIYE
Caner	ŞİMŞİR	TURKIYE
Ming-Yi	TSAI	TAIWAN
Kazim	TUR	TURKIYE
Y, Samim	ÜNLÜSOY	TURKIYE
Yusuf	USTA	TURKIYE
Orhan	YILDIRAN	TURKIYE
Orhan	YILDIRIM	TURKIYE
YANG	YUN	P.R.C.

SPONSORS

ORS

MAIB

RENAULT

AES

SPINNER

USEL

TIAD

BIAS

TEKNODROM

İĞREK

DİRİNLER

Conference Secretariat

ORIGIN Event Management Company
Kozyatağı Mahallesi, Forsa sok. No. 18/4, Şenesenevler- Kadıköy/ Istanbul
TEL: +90 216 372 23 30 FAX:+90 216 372 23 31

www.originemc.com.tr
info@originemc.com.tr

Contact Adress

http://www.umtik.com
umtik@metu.edu.tr

PREFACE

It was thirty years ago when six young professors of the Mechanical Engineering Department of the Middle East Technical University started UMTIK conferences as a national event. The Members of the Organizing Committee of the first UMTIK Conference will be with us on the 2nd July 2014 to bring us back to 1984 in a special session "From 1984 to 2014 30 Years of UMTIK Conferences" where the chronological development of UMTIK conferences until 2014 and the future of UMTIK will be discussed with all the participants.

Professor Yusuf Altıntaş is the Honorary Speaker of UMTIK 2014. He is the holder of 2013 special scientific award of TÜBİTAK (Scientific and Technological Research Council of Turkey) in Science and Engineering (2013). He will be delivering his speech on "University – Industry Research Partnership Models In Manufacturing Engineering" right after the opening session.

The first day program will continue by a Panel Discussion Session on "Realisation of Transformation in Manufacturing, Decreasing the Dependency on Import" organized by Professor Ulvi Şeker, Adviser to the Ministry of Science, Industry and Technology and to be moderated by Professor Ersan Aslan, Undersecretary to the Ministry of Science, Industry and Technology. There will be four panelists to represent the Ministries of Economy, Energy and Natural Resources, Development, Transport, Maritime Affairs and Communications at the level of undersecretaries or senior officers. The panel will be conducted in Turkish; but simultaneous translation to English will be provided to the audience.

There will be 49 (15 in Turkish) papers to be presented in 17 regular sessions (3 in Turkish) and 15 papers to be presented in four special sessions on three different topics: "Design Science and Timeaxis Design" organized by Professor Yoshiyuki Matsuoka, "Optimization of Mechanical Systems" organized by Dr. Erdem Acar and "Design for Transport Safety" by Professor Serpil Acar.

Two keynote speeches will be delivered: "Performance Prediction of Coated Tools based on Innovative Procedures to Detect Properties of the Compound Film-Interface Substrate" by Professor K. D. Bouzakis, and "Advances in Cryogenic and Ultrasonic Assisted Machining" by Professor Stuart Barnes in plenary sessions.

Three plenary sessions are reserved for the conference sponsors to make presentations about their companies/associations. We hope these sessions give an opportunity to the participants to learn the capabilities of the sponsoring companies for possible future partnerships.

UMTIK 2012 starts with “Machining Day”, UMTIK 2014 will close with “Machining Day”. “Machining Day” program has 20 papers to be presented in 5 plenary sessions.

We highly acknowledge the Honorary Chair Persons of the Conference: Presidents of the three universities, Professor Ahmet Acar of the Middle East Technical University, Professor Abdurrahim Özgenoğlu of Atılım University and Professor Candeğer Yılmaz of Ege University for their kind support. We also highly acknowledge Professor Ersan Aslan, Under Secretary of the Ministry of Science, Industry and Technology, Professor Ulvi Şeker, Adviser to the Ministry and Assoc. Prof. Dr. Rasim Akpınar, Director of Izmir Directorate, Ministry of Science, Industry and Technology for organizing the Panel Discussion and for their support. We would like to thank the panellists, the Honorary Speaker, Professor Yusuf Altıntaş, the keynote speakers, special session organizers, session chair persons, the authors and all participants for their valuable contributions. Bahram Lotfi Sadigh, a Ph.D. candidate in METU, is gratefully acknowledged for the tremendous time and effort he spent in every aspect of conference organization..

Last, but not the least, we would also like to thank our main sponsor TUBITAK, “The Scientific and Technological Research Council of Turkey”, sponsors, the International Program Committee Members, the referees, our conference secretariat, ORIGIN, and all those who contributed to the success of UMTIK 2014.

We wish all the participants a highly memorable time during their stay in Izmir.

The Organizing Committee

UMTIK 2014, 30th June – 3rd July 2014

İzmir, Türkiye

PREFACE TO MACHINING DAY IN UMTIK 2014

This year we will have the second Machining Day in UMTIK Conferences. The first one was held in 2012 in Pamukkale as a tribute to Prof. Altintas of UBC for his achievements and contributions to manufacturing science and engineering. Not suprisingly, shortly after that Prof. Altintas received Special Award from TUBITAK in 2013 (The Scientific and Technological Research Council of Turkey) in addition to many others he has been awarded. We had interesting presentations and good discussions in the first Machining Day during and after the sessions. This year we have 20 interesting presentations grouped in 4 sessions: Experimental Methods, Multi Axis Machining, Machine Tool Dynamics and Process Modeling. We again hope that these presentations will create a dynamic atmosphere stimulating interaction among participants. We welcome all of you to İzmir and wish you a productive and pleasant stay.

"Machinin Day" Organizers

Prof. Dr. Erhan Budak Prof. Dr. İsmail Lazoglu

JUNE 30, 2014 – MONDAY			
8:00- 9:00	**REGISTRATION**		
9:00-10:30	**OPENING SESSION**		
10:30-11:15	**(I1) Grand Hall** **Honorary Keynote Speaker:** Prof. Dr. Yusuf Altıntaş "University- Industry Research Partnership Models in Manufacturing Engineering"		
11:15-11:30	**COFFEE BREAK**		
11:00-13:30	**(I2) Grand Hall** **PANEL** **REALISATION OF TRANSFROMATION IN MANUFACTURING** "Decreasing the Dependency on Import" Moderator: Prof.Dr. Ersan Aslan Undersecretary, Ministry of Science, Industry and Technology		
13:30-14:30	**LUNCH**		
14:30-15:15	**(I3) Grand Hall** **SPONSORS SESSION**		
15:15-16:45	**Hall 1**	**Hall 2**	**Hall 3**
	A1 **Special Session: Design Science and Time-axis Design** YM1, YM2, YM3, YM4	**B1** **Resource Management and Sustainability in Manufacturing** ME1, ME2, ME3	**C1** **Endüstriyel Uygulamalar** 6,9,25,45
16:45-17:00	**COFFEE BREAK**		
17:00- 18:30	**Hall 1**	**Hall 2**	**Hall 3**
	A2 **Smart and Intelligent Design, Design Models and Machines** 17, 22, 72, 74	**B2** **Mekanik Yapılar ve Analizleri** 24, 32, 37, FO1	**C2** **Industrial Applications** FO3, FO4, 20, 80
20:00	**COCKTAIL**		

JULY 1, 2014 - TUESDAY			
9:00- 9:45	**(I4) Grand Hall** **Keynote Speaker:** Prof. Dr. K. -D. BOUZAKIS "Cutting Performance Prediction of Coated Tools Based on Innovative Procedures to detect Properties of the Compound Film-Interface- Substrate"		
	Hall 1	**Hall 2**	**Hall 3**
9:45-11:15	**A3** **Design of Machines and their Applications I** 18, 30, 36	**B3** **Special Session: Design for Transport Safety I** SA1, SA2, SA3, SA4	**C3** **Machining** 39, 56, 84
11:15- 11:30	**COFFEE BREAK**		
	Hall 1	**Hall 2**	**Hall 3**
11:30- 13:00	**A4** **Design for Machines and their Applications II** 44, 47, 50	**B4** **Special Session: Design for Transport Safety II** SA5, SA6, SA7, SA8	**C4** **Design for Production Processes** 35, 43, 70, 83
13:00-14:00	**LUNCH**		
14:00- 14:45	**(I5) Grand Hall** **SPONSORS SESSION**		
	Hall 1	**Hall 2**	**Hall 3**
14:45-16:15	**A5** **Design for Machines and their Applications III** 51, 82, 85	**B5** **Advanced Materials in Manufacturing I** 2, 3, 5, 13	**C5** **Non-Traditional Machining Processes** 12, 16, 55
16?15- 16:30	**COFFEE BREAK**		
	Hall 1	**Hall 2**	**Hall 3**
16:30- 18:00	**A6** **Finite Element Analysis Applications in Design and Manufacturing** 8, 46, 81	**B6** **Advanced Materials in Manufacturing II** 61, 62, 69, 77	**C6** **Yeni ve Alışılmamış İmalat Yöntemleri** 15, 28, 29

JULY 2, 2014, WEDNESDAY			
9:00- 9:45	**(I6) Grand, Hall** **Keynote Speaker:** Assoc. Dr. Stuart BARNES "Advances in Cryogenic and Ultrasonic Assisted Machining"		
9:45-11:15	**Hall 1**	**Hall 2**	**Hall 3**
	A7 **Special Session: Optimization of Mechanical Systems and/or Manufacturing** EA1, EA2, EA3	**B7** **Modeling and Analysis of Mechanical Systems** 27, 60, 67	**C7** **Talaşlı İmalat** 21, 23, 41, 57
11:15- 11:30	**COFFEE BREAK**		
11:30- 12:15	**(I7) Grand Hall** **SPONSORS SESSION**		
12:15-13:45	**Hall 1**	**Hall 2**	**Hall 3**
	A8 **Current State of the Art in Taiwanese and Turkish Machine Tool Industry**	**B8** **Modeling and Analysis of Failure in Mechanical Systems** 33, 73, 78, 86	**C8**
13:00-14:00	**LUNCH**		
14:45-15:30	**(I8) Grand Hall** **From 1984 to 2014** **30 Years of UMTIK CONFERENCES**		
20:00	**CONFERENCE DINNER**		

	JULY 3, 2014, THURSDAY
	MACHINING DAY PROGRAM
8:30- 8:50	**WELCOME AND INTRODUCTION**
8:50- 10:30	**SESSION 1: EXPERIMENTAL METHODS**
8:50- 9:10	Investigating the Effects of Variable Feed Rate on Tool Life in Turning
9:10- 9:30	Experimental Investigation of Double Point Angle Polycrystalline Diamond Drill Geometries
9:30- 9:50	Experimental Investigation of CGI Drilling Adapted with External MQL System
9:50- 10:10	Performance Of Novel A/B-SiAlOn-TiN Ceramic Composites on High Speed Milling of Inconel 625
10:10- 10:30	High Efficiency Elliptical Vibration Cutting of Hardened Steel with Large Nose Radius Single Crystal Diamond Tool
10:30- 10:50	**COFFEE BREAK**
10:50- 12:30	**SESSION 2: MULTI AXIS MACHINING**
10:50-11:10	Verification of Cone Frustum Accuracy Test of Five-Axis Machining Center
11:10-11:30	Effect of Joint Stiffness on the Dynamic Performance of the Machine Tool
11:30- 11:50	The Effect of Tool Orientation on Five Axis Ball End Milling of Ti6Al4V
11:50- 12:10	A Study of A Postprocessor System for A Hybrid Parallel-Serial Five-Axis Machine Tool
12:10- 12:30	Modelling of Turn-Milling Processes for Increased Productivity
12:30- 13:40	**LUNCH**
13:40- 16:00	**SESSION 3: MACHINE TOOL DYNAMICS**
13:40- 14:00	Mechatronic Spindle Head for Chatter Suppression in Heavy Duty Operations
14:00- 14:20	Influence of the Spacer Clearance on the Dynamic Characteristics of A Spindle Tool
14:20- 15:00	Comparison of Damping Properties of Spindle Bearings
15:00- 15:20	Active Damping of Heavy Duty Milling Operations
15:20- 15:40	A Model of Tool Point Dynamics Considering Effects of Bi-Distributed Joint Interfaces
15:40- 16:00	**COFFEE BREAK**
16:00- 17:40	**SESSION 4: PROCESS MODELING**
16:00- 16:20	Mechanics and Dynamics of Multi-Functional Tools
16:20- 16:40	The Mechanics of Double-Sided Milling Operation
16:40- 17:00	Work-piece Surface Burn Detection by Force and Temperature Modeling for Grinding Operations
17:00- 17:20	Force Model for Micro Milling of Free Form Surfaces
17:20- 17:40	Single Grit Scratch Tests to Explore the Material Removal Mechanism in Grinding at Micro Scale

(I1)	**Keynote Lecture**	**HALL 1**	**10:30–11:15**

***Chaired by**: Prof. Dr. K. -D. BOUZAKIS*

"University- Industry Research Partnership Models in Manufacturing Engineering"
Keynote Speaker: Prof. Dr. Yusuf Altıntaş

(I2)	**Panel**	**HALL 1**	**11:30–13:30**

REALISATION OF TRANSFROMATION IN MANUFACTURING
"Decreasing the Dependency on Import"

***Moderator:** Prof.Dr. Ersan ASLAN*

(I 3)	**Sponsors Session**	**HALL 1** **TÜBİTAK, ORS**	**14:30–15:00**

***Chaired by:** Prof. Dr. Ulvi ŞEKER*

(A1)	**Special Session:** **Design Science and Time-axis Design**	**HALL 1**	**15:15- 16:45**

***Organized and chaired by:** Prof. Dr. Yoshiyuki MATSUOKA*

APPLICATION OF M METHOD AND CONSIDERATION OF MEASURES TO ADAPT FOR DIVERSE USERS (YM1)
Shuji KANAZAWA, Yuma SAKAE, Shuji TAKANO, Koichiro SATO, Yoshiyuki MATSUOKA

MULTISPACE QUALITY FUNCTION DEPLOYMENT USING DESIGN STRUCTURE MATRIX (YM2)
T. KATO, T. SOGA, Y. HOSHINO

VALUE GROWTH MOBILITY BASED ON TIMEAXIS DESIGN (YM3)
Yuma KUSUNOKI, Kei KAMIYA, Akira KITO, Koichiro SATO, Yoshiyuki. MATSUOKA

CONCEPTUAL STRUCTURING OF MODULAR DESIGN METHODOLOGY FOR MECHATRONIC SYSTEMS: BEHAVIOUR BASED DESIGN PERSPECTIVE (YM4)
Zuhal ERDEN

(B1) Resource Management and Sustainability in Manufacturing **HALL 2** **15:15- 16:45**

Chaired by: *Dr Hamdullah MERDANE*

A DECISION SUPPORT SYSTEM FOR SELECTION OF BIO-MATERIALS (48)
M. Alper SOFUOGLU, Sezan ORAK

EXTENDED MODELS FOR SUPPORTING CAPP-MES INTEGRATION IN DISCRETE PRODUCTION SYSTEMS (53)
Tibor TÓTH, Gyula KULCSÁR, Ferenc ERDÉLYI, Mónika KULCSÁRNÉ FORRAI, Péter BIKFALVI

CONCEPTUALIZATION OF A WEB-BASED SOFTWARE PLATFORM THAT ENABLES CLEANER PRODUCTION AND INDUSTRIAL SYMBIOSIS (65)
Tuna Çağlar GÜMÜŞ, Christoph HUGI, Dirk HENGEVOSS, S. Engin KILIÇ, Guillaume MASSARD, Murat ÖZBAYOĞLU, Hakkı Özgür ÜNVER

INVESTIGATION OF FREE-FORM SURFACE RECONSTRUCTION TECHNIQUES FOR REVERSE ENGINEERING OF WORN-OUT GAS TURBINE BLADES: A CASE STUDY (79)
Özgür POYRAZ, Oğuzhan YILMAZ, Evren YASA

(C1) Endüstriyel Uygulamalar **HALL 3** **15:15- 16:45**

Chaired by: *Prof. Dr. Oktay ALNIAK*

KALIP DEĞİŞİMLERİNDE HİDROLİK SABİTLEYİCİ KULLANILMASININ AVANTAJLARI (6)
Ersel ÖZDEN, Ebru TAŞKIN, Orçun YÖNTEM, R.Güçlü ARIKAN

OTOMOTİV ENDÜSTRİSİNDE KULLANILAN 3 BOYUTLU PARÇALARIN KESİMİ İÇİN LAZER KESİM TEZGÂHLARI (9)
Hakan DEMİR, Tayfun SIĞIRTMAÇ

HOTMELT TEKNOLOJİSİ İLE ENKAPSÜLASYON UYGULAMASI VE ELEKTRONİK DONANIM GÖVDELENDİRME ÖRNEK PROSES İNCELEMESİ (25)
Burhan ÖZUĞUR, Serhat APAK

DÜZE ANA DELİK ÇAP DEĞERLERİNİN HAVA AKIMI VE İPLİK TÜYLÜLÜĞÜ ÜZERİNDEKİ ETKİLERİ (45)
D. YILMAZ, M.R. USAL

(A2)	Smart and Intelligent Design Design Models and Machines	HALL 1	17:00–18:30

Chaired by: *Assoc. Prof. Dr. Yukitoshi IHARA*

EVALUATION OF A SCANNING TECHNIQUE USED FOR MEDICAL DESIGN APPLICATIONS (17)
Octavian CIOBANU, Gabriela CIOBANU

BIOINSPIRED TRANSFORMATION FOR DESIGN OF BIOROBOTS (22)
Aylin KONEZ EROĞLU, Zuhal ERDEN, Abdulkadir ERDEN

DEVELOPMENT OF AN AUTONOMOUS LAWN MOWER (72)
Serkan ÇİÇEK, E. İlhan KONUKSEVEN, A. Buğra KOKU

DESIGN OF A HUMANOID ROBOT SPINE CONSTRUCTED OF ASYMMETRIC PARALLEL MECHANISM MODULES(74)
Ekim YURTSEVER, Şeniz ERTUĞRUL

(B2)	Mekanik Yapılar ve Analizleri	HALL 2	17:00–18:30

Chaired by: *Prof. Dr. Şeniz ERTUĞRUL*

TAKIM TEZGAHLARINDAKİ BİLYALI VİDALI MİL HAREKET SİSTEMİNİN EKSENEL VE BURULMA TİTREŞİMLERİNİN İNCELENMESİ (24)
Muhammet ERDÖL, Hasan KURTARAN

PETEK YAPILI SANDVİÇ YAPILARIN DİNAMİK ÖZELLİKLERİNİN İNCELENMESİ (32)
M. Fatih ŞANSVEREN, Alparslan YİĞİT, Mustafa YAMAN

ALÜMİNYUM MATRİSLİ FONKSİYONEL DERECELENDİRİLMİŞ MALZEMEDE ÇATLAK İLERLEYİŞİNİN DENEYSEL ANALİZİ (37)
Arzum ULUKÖY, Muzaffer TOPÇU, Süleyman TAŞGETİREN

METAL ŞEKİLLENDİRME PROSESİ ÜZERİNDEN GERİ ESNEME TELAFİ YÖNTEMLERİNİN İNCELENMESİ (FO1)
Emre ESENER, Mehmet FIRAT

(C2)	Industrial Applications	HALL 3	17:00–18:30

Chaired by: *Dr. Tayfun SIĞIRTMAÇ*

DEFECTS AND REMEDIES IN ADVANCED HIGH STRENGTH STEELS STAMPING (FO3)
Ilyas KACAR, Fahrettin OZTURK, Firas JARRAR

RECENT TRENDS OF APPLICATION OF ADVANCED HIGH-STRENGTH STEELS IN AUTOMOTIVE INDUSTRY TO ENHANCE SUSTAINABILITY (FO4)
Suleyman KILIC, Fahrettin OZTURK

NOISE IN HYDRAULIC SYSTEMS AND PREVENTION METHODS (20)
H.Sevil ERGUR, Yasar PANCAR

CONTAMINATION PHENOMENA AND PREVENTION METHODS IN HYDRAULIC SYSTEMS (80)
H.Sevil ERGUR

July 1, 2014 (Tuesday)

(I 4)	Keynote Lecture	HALL 1	9:00- 9:45

Chaired by: *Prof. Dr. Yusuf ALTINTAŞ*

"CUTTING PERFORMANCE PREDICTION OF COATED TOOLS BASED ON INNOVATIVE PROCEDURES TO DETECT PROPERTIES OF THE COMPOUND FILM-INTERFACE- SUBSTRATE"
Keynote Speaker: Prof. Dr. K. -D. BOUZAKIS

(A3)	Design for Machines and their Applications I	HALL 1	9:45- 11:15

Chaired by: *Dr. Zuhal ERDEN*

DESIGN AND VALIDATION OF A THREE-AXIS HIGH-PRECISION POSITIONING SYSTEM FROM MECHATRONICALLY MODULAR COMPONENTS (18)
Erva ULU, Nurcan GECER-ULU, Melih ÇAKMAKCI

VIBRATION AND BIFURCATION ANALYSIS OF ULTRA SHORT AEROLUBRICATED JOURNAL BEARING SYSTEM (30)
C. C. WANG, H. T. YAU

MECHANICAL STRUCTURE DESIGNS FOR TWO AXIS SOLAR TRACKERS (36)
H. Orhan YILDIRAN

(B3)	Special Session: Design for Transport Safety I	HALL 2	9:45- 11:15

Organized and Chaired by: *Professor Dr. Serpil ACAR*

PREGNANT OCCUPANT MODEL DESIGN TO IMPROVE SAFETY (SA1)
B. Serpil ACAR, Moustafa MERIC, Memis ACAR

A FEM-MB MIXED METHODOLOGY TO ANALYZE THE PASSIVE SAFETY PERFORMANCES OF A PASSENGER SEAT FOR RAILWAY USE (SA2)
Francesco CAPUTO, Giuseppe LAMANNA

OPTIMIZATION STUDY ON MULTI-BODY VEHICLE-FRONT MODEL FOR PEDESTRIAN SAFETY (SA3)
Hariharan S. SUBRAMANIAN, Anoop CHAWLA, Sudipto MUKHERJEE, Dietmar GOEHLICH

DESIGN CONCEPT FOR AN INTEGRATED WHIPLASH MITIGATING HEADRESTRAINTS AND CAR SEAT (SA4)
M. ACAR, S.R. BEWSHER

(C3) Machining	HALL 3	9:45- 11:15

Chaired by: *Assoc. Prof. Dr. Stuart BARNES*

THE TOOL-CHIP CONTACT LENGTH USING A NEW SLIP LINE SOLUTION FOR ORTHOGONAL CUTTING (39)
Shao-Hsien CHEN

MODELLING OF CUTTING FORCES IN FACE MILLING Ti6Al4V SUPERALLOY WITH a-CN/TiAIN COATED CARBIDE TOOLS (56)
Halil ÇALIŞKAN

THE EFFECTS OF CUTTING PARAMETERS ON CHIP-TOOL INTERFACE TEMPERATURE AND SURFACE ROUGHNESS IN TURNING OF WASPALOY (84)
M. Cemal CAKIR, Abdil KUS, Yahya ISIK

(A4) Design for Machines and their Applications II	HALL 1	11:30–13:00

Chaired by: *Prof. Dr. Octavian CIOBANU*

A CPG BASED GAIT GENERATION FOR 12 DOF BIPED ROBOT (BIROL) USING ZMP CRITERIA (44)
M. Hassan Gol.M.Z, Kutluk B. ARIKAN, Bülent İRFANOĞLU

INNOVATIVE VIRTUAL MACHINE TOOL DESIGN (47)
Tzuo-Liang LUO, Chien-Chih LIAO, Z. Murat KILIÇ, Yusuf ALTINTAŞ

DESIGN AND ANALYSIS OF A PARALLEL MECHANISM FOR KINEMATICALLY REDUNDANT HYBRID PLANAR LASER CUTTING MACHINE (50)
M. İ. Can DEDE, Erkin GEZGİN, Gökhan KİPER, Ercan MASTAR, Tayfun SIĞIRTMAÇ, Emre UZUNOĞLU

(B4) Special Session: Design for Transport Safety II — **HALL 2** — **11:30–13:00**

Organized and Chaired by: *Prof. Dr. Serpil ACAR*

STRUCTURAL CRASHWORTHINESS ANALYSIS OF A PICKUP TRUCK SUBJECTED TO POLE SIDE IMPACTS (SA5)
M. Ozan KOCABAŞ, Eren ÜNSAL, Volkan ESAT

CRASHWORTHINESS OF GUARDRAIL POST EMBEDDED IN COHESIONLESS SOIL (SA6)
Sassi ABDELMONAAM, Faouzi GHRIB

EFFECTS OF CHASSIS GEOMETRY ON STRUCTURAL CRASHWORTHINESS OF A PICKUP TRUCK IN FULL-FRONTAL IMPACTS (SA7)
Semih DAĞDEVİREN, Mecit YAVUZ, Volkan ESAT

HYBRID RFID SYSTEM FOR DRIVER ASSISTANT AND ACTIVE ROAD ACCIDENT PREVENTION (SA8)
Huanjia YANG, Shuang-hua YANG

(C4) Design for Production Processes — **HALL 3** — **11:30–13:00**

Chaired by: *Prof. Dr. Memiş ACAR*

MODELLING CONE ANGLE DEFORMATION OF MICROTUBES IN FLARING PROCESS (35)
Tsung-Chia CEHN, Wei-Kai CENG

FABRICATION OF MICROFLUIDIC DEVICES FOR DIELECTROPHORETIC AND ACOUSTOPHORETIC APPLICATIONS USING HIGH-PRECISION MACHINING (43)
Soheila ZEINALI, Barbaros ÇETIN, M. Bülent ÖZER, Süleyman BÜYÜKKOÇAK

MICROMACHINING WITH NS-PULSED FIBRE LASERS: MATERIALS, APPLICATIONS AND SECTORS (70)
Ali Gökhan DEMİR, Barbara PREVITALI

EXPERIMENTAL INVESTIGATION OF THE PROCESS PARAMETERS ON THE FORMING FORCE FOR SINGLE POINT INCREMENTAL FORMING (83)
Barış ÖZGEN, İsmail LAZOĞLU, İsmail DURGUN

(I 5) Sponsors Session HALL 1 14:00–14:45
OYAK-RENAULT, TEKNODROM, İĞREK MAKİNE, BIAS

Chaired by: *Assoc. Prof. Dr. İ.Etem SAKLAKOĞLU*

(A5) Design for Machines and their Applications III HALL 1 14:45- 16:15

Chaired by: *Dr. Melih ÇAKMAKÇI*

CONTACT LINE ANALYSIS OF WORM GEARINGS HAVING ARCHED PROFILE (51)
László DUDÁS

DEVELOPMENT OF A TEST SYSTEM FOR VISCOELASTIC MATERIAL CHARACTERIZATION (82)
Fulya EROL, Gökhan O. ÖZGEN, Halil ARDIÇ, Bilgehan ERDOĞAN, S. Samet ÖZKAN

ROBUST FUZZY-PID CONTROL OF AN UNBALANCED QUADROTOR (85)
Ahmed AKSAL, Kutluk Bilge ARIKAN, Fuad ALİEW

(B5) Advanced Materials in Manufacturing I HALL 2 14:45- 16:15

Chaired by: *Assoc. Prof. Dr. Fahrettin ÖZTÜRK*

INVESTIGATION OF THE EFFECT OF TITANIUM (TI) ADDITION TO THE MG-AZ31 ALLOY IN THE CAST CONDITION AND AFTER EXTRUSION AND ITS EFFECT ON METALLURGICAL AND MECHANICAL CHARACTERISTICS (2)
ADNAN I .O. ZAID, RAGHAD, S. HEMEIMAT

EFFECT OF MOLYBDENUM ADDTION TO ZINC-ALUMINUM 22, ZA22, ALLOY ON GRAIN SIZE AND MECHANICAL PROPERTIES AFTER PRESSING BY THE EQUAL CHANNEL ANGULAR PRESSING, ECAP (3)
Adnan I. O. ZAID, Jehad A. S. ALKASASBEH, Safwan M. A. ALQAWABAH

EFFECT OF Zr ADDITION ON THE MECHANICAL CHARACTERISTICS AND WEAR RESISTANCE OF Al GRAIN REFINED BY Ti AFTER EXTRUSION (5)
Adnan I. O. ZAID, Safwan M. A. ALQAWABAH

METAL FORMING PROCESSES IN GENERAL AND IN FORGING IN PARTICULAR (13)
Adnan I.O.ZAID, Hebah B. MELHEM

(C5) Non-Traditional Machining Processes	HALL 3	14:45- 16:15

Chaired by: *Dr. Barbaros ÇETIN*

COPPER POWDER REINFORCED POLYESTER ELECTRODES IN ELECTRIC DISCHARGE MACHINING (12)
Kemal YAMAN, Can ÇOĞUN

DEVELOPMENT AND ANALYSIS OF DOUBLE-FACED WITH RADIAL AND CLUSTER-ARRANGED CMP DIAMOND DISK (16)
M. Y. TSAI, C. H. CHEN, J. H. CHIANG

EFFECTS OF CUTTING PARAMETERS ON THE MATERIAL REMOVAL RATE AND SURFACE QUALITY OF AL 7075 IN TURNING OPERATION WITH ABRASIVE WATERJET MACHINE (55)
Muhammad A.HASAN, Mustafa DERE, İ. Hüseyin FİLİZ,

(A6) Finite Element Analysis Applications in Design and Manufacturing	HALL 1	16:30-18:00

Chaired by*: Mr. Chih Chung FENG*

FINITE ELEMENT ANALYSIS OF FINGER JOINT IMPLANT (8)
T. AZIZ, S. Saied DARWISH, A. M. AL-AHMARI, Hazem al KHAWASHKI

CHARACTERIZATION OF C67S SHEET METAL AND DESIGN OF MANUFACTURING STEPS WITH FINITE ELEMENT ANALYSIS (46)
H. Onat TUĞRUL, D. Kıvanç AKSUNGUR, Celalettin KARADOĞAN

IMPLEMENTATION OF RATE-AND-STATE FRICTION LAW IN FINITE ELEMENT SIMULATION OF SLIDING MOTION USING USER-DEFINED SUBROUTINE (81)
Babak RAJIHAMED, Demirkan ÇÖKER

(B6)	Advanced Materials in Manufacturing II	HALL 2	16:30-18:00

Chaired by: *Mr. Dirk HENGEVOSS*

CHARACTERISTICS OF ALUMINUM FOAM UNDER DIFFERENT LOADING RATES (61)
A. A .HUSSEIN, W. M. CHAIRLADIES, A. A. KHALIL, A. A. NASSER

COMPARISON BETWEEN THE EFFECT OF ZR ADDITION TO AL GRAIN REFINED BY TI OR TI+B ON ITS MECHANICAL CHARACTERISTICS IN THE AS CAST AND AFTER EXTRUSION (61)
Safwan M. A. ALQAWABAH, Adnan I. O. ZAID

PARTICLE DEPOSITION IN RESIN TRANSFER MOLDING OF ADVANCED COMPOSITES (69)
Tugce Aydil Dalkiran, Hamed Tanabi, Merve Erdal

DEFORMATION OF SUPER ALLOYS AT ELEVATED TEMPERATURES (77)
M. Oktay ALNIAK

EFFECT OF ADDITION OF TANTALUM (Ta) ON THE MECHANICAL BEHAVIOR ON THE FATIGUE LIFE OF THE ZINC-ALLUMINUM ALLOY (77)
Adnan I.O. ZAID, Du'a O. R. WERAIKAT

(C6)	Yeni ve Alışılmamış İmalat Yöntemleri	HALL 3	16:30-18:00

Chaired by: *Dr. H. Özgür ÜNVER*

ELEKTROLİTİK ve ALAŞIM BAKIR ELEKTROTLARIN ELEKTRO-EROZYON İLE İŞLEME PERFORMANSINA ETKİSİ (15)
Ülke ŞİMŞEK, Can ÇOĞUN

SAÇ MODELLEME: FONKSİYONEL PARÇALARIN İMALATI İÇİN EKLEMELİ İMALAT YÖNTEMİ (28)
Uğur ERKEN, Hasan Erdem HARMAN, Serdar SEÇKİN, Emin Faruk KEÇECİ

LAZER OYMA İŞLEMİNİN WC-Co YÜZEY ÖZELLİKLERİNE ETKİLERİNİN ARAŞTIRILMASI (29)
Şefika KASMAN, İ.Etem SAKLAKOĞLU

(I6)	Keynote Lecture	HALL 1	9:00-9:45

Chaired by: *Prof. Dr. Christoph HUGI*

"ADVANCES IN CRYOGENIC AND ULTRASONIC ASSISTED MACHINING"
Keynote Speaker: Assoc. Dr. Stuart BARNES

(A7)	Special Session: Optimization of Mechanical Systems and/or Manufacturing	HALL 1	9:45-11:15

Organized and chaired by: *Assoc. Prof. Dr. Erdem ACAR*

SHAPE OPTIMIZATION OF 2D RUBBER BUSHING USING DIFFERENTIAL EVOLUTION ALGORITHM (EA1)
Necmettin KAYA

STRUCTURAL OPTIMIZATION OF BLADE – DISC FIRTREE ATTACHMENT OF AN AERO-ENGINE (EA2)
Erdem ACAR, Mutlu GÜNDÜZ

DEVELOPMENT OF NEW CRASH BOXES FOR AUTOMOTIVE INDUSTRY (EA3)
Emre DEMİRCİ, Ali Rıza YILDIZ, Fehim SEMERCİ

(B7)	Modeling and Analysis of Mechanical Systems	HALL 2	9:15-10:45

Chaired by: *Assoc. Prof. Dr. Laszlo DUDAS*

NONLINEAR FREE VIBRATION ANALYSIS OF NONUNIFORM ROTATING DOUBLE WALLED CARBON NANOTUBES (27)
Hamed SAMANDARI, Ender CIĞEROĞLU

CHARACTERISTIC OF ANCHOR EMBEDDED ON CONCRETE UNDER DIFFERENT LOADING RATE (60)
SH. M. ISMAEL, W. M. KHAIR-ALDIEN, A. A. KALIL, A. A. NASSR

CONTACT AND BENDING STRESS ANALYSIS OF SPUR GEAR DRIVES (67)
Sadık OLGUNER, İ. Hüseyin FİLİZ

(C7) Talaşlı İmalat	HALL 3	9:45-11:15

Chaired by: *Dr. Evren YASA*

SERT MALZEMELERİN TORNALAMASI İŞLEMLERİNDE TAKIM AŞINMASINI ETKİLEYEN FAKTÖRLERİN TEPKİ YÜZEYİ METODOLOJİSİ İLE BELİRLENMESİ (21)
Dilek MURAT, M. Cemal ÇAKIR, Necmi GÜRSAKAL, Ali ORAL

55 HRC SERTLİKTEKİ AISI H13 TAKIM ÇELİĞİNİN YÜKSEK İLERLEME İLE FREZELENMESİNDE OLUŞAN TAKIM AŞINMASI - KALICI GERİLME İLİŞKİSİNİN ARAŞTIRILMASI (23)
Selim KOCA, M. Cemal ÇAKIR

FARKLI SOĞUTMA ŞARTLARI İLE FARKLI KESME PARAMETRELERİNİN AA7075 VE AA2024 ALÜMİNYUM ALAŞIMLARINDA DELİK DELME İŞLEMLERİNE ETKİSİNİN DENEYSEL OLARAK İNCELENMESİ (41)
Ayşegül ÇAKIR, Onur BAHTİYAR, Ulvi ŞEKER

AISI H13 TAKIM ÇELİĞİNİ YÜKSEK HIZLI İŞLEME PARAMETRELERİNİN TAGUCHİ YÖNTEMİYLE OPTİMİZASYONU VE YAPAY SİNİR AĞLARIYLA YÜZEY PÜRÜZLÜLÜĞÜ TAHMİNİ (57)
Mustafa HAMAMCI, E. Sabri TOPAL

(I7) Sponsors Session	HALL 1 SPINNER, USEL, TIAD	11:00–11:45

Chaired by: *Assoc. Prof. Dr. Ali ORAL*

(A8) Current State of the Art in Taiwanese and Turkish Machine Tool Industry **HALL1** **12:15-13:45**

Chaired by: *Assoc. Prof. Dr. Peter BIKFALVI*

BUSINESS DEVELOPMENT AND TECHNOLOGY APPLICATION OF MACHINE TOOL SPINDLES IN ASIA MARKET
Chui Hsi, Oliver TSAI

ON RESEARCH COLLABORATION OF ITRI AND INDUSTRY AND MAL OF UBC
Tzuo Liang LUO

VIBRATION INSTRUMENT AND APPLICATION PROVIDER
Robert BENJAMIN

MACHINE TOOL INDUSTRY IN TURKEY
Erdal GAMSIZ

(B8) Modeling and Analysis of Failure in Mechanical Systems **HALL2** **12:15-13:45**

Chaired by: *Assoc.Prof. Dr. Erdem ACAR*

A STUDY OF SOME THREE-DIMENSIONAL ISSUES IN MODIFIED ARCAN LOADING DEVICE UNDER MIXED-MODE LOADING CONDITIONS (33)
Abuzar ES'HAGI OSKUI, Naghdali CHOUPANI, Morteza SOLTANPOUR KHAMNEH

DYNAMICS BEHAVIOR ANALYSIS OF CRACKED SHAFT IN ROTATING MACHINERY (73)
Hamit SARUHAN, Fikret POLAT, Mert KILINÇEL

VOID COALESCENCE THROUGH INTERNAL NECKING: THOMASON'S CRITERION REVISITED (78)
Cihan TEKOĞLU, Sanaz ATTARİ, Jean-Baptiste LEBLOND, Thomas PARDOEN

EXPERIMENTAL VIBRATION ANALYSIS OF SIMULATED SHAFT CRACK (86)
Hamit SARUHAN, Mert KILINÇEL, Fikret POLAT

(I8) From 1984 to 2014 *30 YEARS OF UMTIK CONFERENCES* **HALL 1** **14:45-15:30**

Chaired by: *Prof. Dr. Abdulkadir ERDEN*

(A9) Experimental Methods HALL1 8:50-10:30

INVESTIGATING THE EFFECTS OF VARIABLE FEED RATE ON TOOL LIFE IN TURNING
Ali ORAL, M. Cemal ÇAKIR, Demet GÖNEN, A. Deniz KARAOĞLAN

EXPERIMENTAL INVESTIGATION OF DOUBLE POINT ANGLE POLYCRYSTALLINE DIAMOND DRILL GEOMETRIES
Yiğit KARPAT, Onur BAHTİYAR

EXPERIMENTAL INVESTIGATION OF CGI DRILLING ADAPTED WITH EXTERNAL MQL SYSTEM
A. Taner KUZU, U. Alican ALMA, Kaveh RAHIMZADEH BERENJI, Mustafa BAKKAL

PERFORMANCE OF NOVEL α/β-SiAlON-TiN CERAMIC COMPOSITES ON HIGH SPEED MILLING OF INCONEL 625
Ali ÇELİK, Melike Sert ALAGAÇ, Uğur Evrensel YILMAZ, Alpagut KARA, Servet TURAN, Ferhat KARA

HIGH EFFICIENCY ELLIPTICAL VIBRATION CUTTING OF HARDENED STEEL WITH LARGE NOSE RADIUS SINGLE CRYSTAL DIAMOND TOOL
Yilong WANG, Eiji SHAMOTO

(A10) Multi Axis Machining HALL1 10:50- 12:30

VERIFICATION OF CONE FRUSTUM ACCURACY TEST OF FIVE-AXIS MACHINING CENTER
Toru TAJIMA, Tomohiro KUBO, Yukitoshi IHARA

EFFECT OF JOINT STIFFNESS ON THE DYNAMIC PERFORMANCE OF THE MACHINE TOOL
Chih CHUNG, Faby FENG, Robert J. BENJAMIN

THE EFFECT OF TOOL ORIENTATION ON FIVE AXIS BALL END MILLING OF Ti6Al4V
S. Ehsan LAYEGH K., İsmail LAZOĞLU

A STUDY OF A POSTPROCESSOR SYSTEM FOR A HYBRID PARALLEL SERIAL FIVE-AXIS MACHINE TOOL
Yuan-Lung LAI, Hsiao-Ying CHAN, Tzuo-Liang LO

MODELLING OF TURN MILLING PROCESSES FOR INCREASED PRODUCTIVITY
Umut KARAGÜZEL, Emre UYSAL, Erhan BUDAK, Mustafa BAKKAL

(A11)	Machine Tool Dynamics	HALL1	13:40- 16:00

MECHATRONIC SPINDLE HEAD FOR CHATTER SUPPRESSION IN HEAVY DUTY OPERATIONS
Iker MANCISIDOR, Jokin MUNOA, Rafael BARCENA, Xabier MENDIZABAL

INFLUENCE OF THE SPACER CLEARANCE ON THE DYNAMIC CHARACTERISTICS OF A SPINDLE TOOL
Jui-Pin HUNG, Kung-Da WU, Chun-Wei LIN, Bing-Jie PENG

COMPARISON OF DAMPING PROPERTIES OF SPINDLE BEARINGS
C. BRECHER, M. Fey, R. HABERMANN

ACTIVE DAMPING OF HEAVY DUTY MILLING OPERATIONS
Robin KLEINWORT, Yusuf ALTINTAŞ, Michael F. ZAEH

A MODEL OF TOOL POINT DYNAMICS CONSIDERING EFFECTS OF BI-DISTRIBUTED JOINT INTERFACES
Yun YANG, Min WAN, Weihong ZHANG

(A12)	Process Modelling	HALL1	16:00-17:40

MECHANICS AND DYNAMICS OF MULTI-FUNCTIONAL TOOLS
Min WAN, Z. Murat KILIÇ, Yusuf ALTINTAŞ

THE MECHANICS OF DOUBLE-SIDED MILLING OPERATION
Z. Murat KILIÇ, Yusuf ALTINTAŞ

WORKPIECE SURFACE BURN DETECTION BY FORCE AND TEMPERATURE MODELING FOR GRINDING OPERATIONS
Deniz ASLAN, Erhan BUDAK

FORCE MODEL FOR MICRO MILLING OF FREE FORM SURFACES
Ali MAMEDOV, İ. E. YİĞİT, Ismail LAZOĞLU

SINGLE GRIT SCRATCH TESTS TO EXPLORE THE MATERIAL REMOVAL MECHANISM IN GRINDING AT MICRO SCALE
Tahsin T. ÖPÖZ, Xun CHEN

KEYNOTE PAPERS

NO	TITLE	AUTHOR
I1	**University- Industry Research Partnership Models in Manufacturing Engineering**	**Yusuf ALTINTAŞ**
I4	**Cutting Performance Prediction of Coated Tools Based on Innovative Procedures to Detect Properties of the Compound Film-Interface- Substrate**	**K. -D. BOUZAKIS**
I6	**Advances in Cryogenic and Ultrasonic Assisted Machining**	**Stuart BARNES**

About The Speaker

Professor Dr. Yusuf ALTINTAŞ

Professor Altintas obtained his Bachelor from Istanbul Technical University (1975), M.Sc. (1980) and Ph.D. (1987) in Canada. He worked as a machine tool manufacturing engineer in Turkey (1977-1978), process development engineer in Pratt & Whitney Canada in Montreal (1980-1981), and the principal engineer of Canadian Institute of Metalworking in Hamilton (1981-1982). He joined University of British Columbia and founded Manufacturing Automation Laboratory in 1986. He conducts research on metal cutting, machine tool vibrations, control and virtual machining. He has published 141 archival journal and 95 conference articles with over 12300 citations with h index of 60 (Google Scholar), and a widely used "Manufacturing Automation: Principals of Metal Cutting Mechanics, Machine Tool Vibrations and CNC Design. 1st ed. 2000, 2nd ed.:2012. His research laboratory created advanced machining process simulation (CUTPRO), virtual part machining process simulation (MACHPRO) and open-modular 5 axis CNC system (Virtual CNC), which are used by over 180 companies and research centers in the field of machining and machine tools worldwide.

Professor Altintas is the fellow of Royal Society of Canada, CIRP, ASME, SME, CAE, EC, Tokyo University, P&WC, AvH and ISNM. He received Pratt & Whitney Canada's (P&WC) university partnership (1997), APEG BC's Meritorious Achievement (2002), APEG BC R.H. McLachlan (2010), UBC Killam Teaching Prize of Engineering (2011), Gold Medal of Engineers Canada (2011), SME Albert M. Sergent Progress Award (2012), NSERC Synergy Award, ASME Blackall Machine Tool and Gage best journal paper award, and the special scientific award of Republic of Turkey in Science and Engineering (2013). He holds an Honorary Doctorate Degrees from Stuttgart University (2009) and Budapest University of Technology (2013).

He currently directs NSERC CANRIMT Machining Research Network across Canada. He holds the NSERC – P&WC Industrial Research Chair Professorship to develop next generation Virtual High Performance Machining Technology since 2002.

UNIVERSITY – INDUSTRY RESEARCH PARTNERSHIP MODELS IN MANUFACTURING ENGINEERING

This paper presents a survey of university – industry research models practiced in North America, Europe and Asia. While universities value scholarly research that leads to archival journal publications with high impact, industry considers only the development of innovative and practical methods which reduce the cost of producing the parts. The author believes that the university researcher cannot try to replicate the practices of engineers in industry. Instead the researcher must try to develop new, science-based methods which lead to archival journal articles, while transferring knowledge to industry by training highly- qualified specialists and packaging the scientific know-how in industry-friendly formats.

About The Speaker

Prof. Dr. K.-D. BOUZAKIS

Professor of the Mechanical Engineering Department, Aristoteles University of Thessaloniki. Director of the Laboratory for Machine Tools and Manufacturing Engineering (EEDM) of the same Department since 1979 and Director of the Fraunhofer Project Center Coatings in Manufacturing (PCCM) since 2008.

- Dipl.-Eng., (National Technical University of Athens)
- Dr.-Ing., (RWTH-Aachen, Germany)
- Habilitation and venia legend (Dr.habil.)(Faculty for Mechanical Engineering RWTH-Aachen, Germany)
- Dr.-Ing.E.h. (University Erlangen-Nuremberg)
- Dr.h.c. (Civic Academy of Bulgaria)
- Visiting Professor (University of Belgrade and University of Kragujevac (Serbia)).
- President of the Greek National Council for Research and Technology (2003-2004)
- President of the Balkan Tribological Association 1996-1999 and 2011-2014.
- Fellow of International Academy for Production Engineering Research (CIRP) since1994.
- Vice chairman (2003-2006) and chairman (2006-2009) of the scientific-technical committee "Cutting" (STC "C") of CIRP
- High level Representative (HLR) of Greece in the European Initiative "EUREKA" 1995-2011.
- Vice President of Natural Gas Distribution Company of Thessaloniki (1997-1999) and President from 2006-2010 of this company.
- Technical consultant of companies and various institutions

Scientific responsible in numerous research projects of the Research Committee of AUTH, European Union, Centre for Research and Technology Hellas (CE.R.T.H), various companies, etc. Co-editor and member of committees of scientific journals.

Activities in the fields of manufacturing technologies, machine tools, coatings, CAD/CAM systems.

5 Books and more than 800 papers, in international Scientific Journals and Conference proceedings.

CUTTING PERFORMANCE PREDICTION OF COATED TOOLS BASED ON INNOVATIVE PROCEDURES TO DETECT PROPERTIES OF THE COMPOUND FILM-INTERFACE-SUBSTRATE

The cutting performance of coated tools can be significantly improved by tailoring the compound film-interface-substrate properties to the application specific requirements. The present paper describes novel analytical-experimental methods for predicting properties, facilitating the quick assessment of the cutting performance of coated tools. Characteristic application's examples of such methodologies are introduced.

In up and down milling of various steels by coated cemented carbide inserts, the effect of the complicated chip geometry and contact conditions between tool and workpiece is crucial for the wear evolution. To approach such contact conditions, repetitive impact tests were conducted at adjustable force signal characteristics on coated cemented carbide inserts. The applied loads correspond to the developed ones in milling when the cutting edge penetrates the workpiece material. Considering these results, the effective tool life is described up to a certain flank wear width dependent on the cutting speed and the cutting edge entry impact duration. An application example will be presented in the case of NC milling a turbine blade of high hardness steel (?56 HRC).

Furthermore, a method for assessing the fatigue strength of nano-composite diamond (NCD) coating interfaces via inclined impact tests is also introduced. Dependent on the applied load, after a certain number of impacts, damages in the film interface region may develop resulting in coating detachment. In this way, residual stresses of the NCD-film are released leading to its lifting (bulge formation). The geometry of the developed film's elevations was sufficiently described by appropriate FEM calculations. Based on the attained impact test results, Woehler-like diagrams were developed for monitoring the fatigue endurance of NCD coating interfaces at various impact conditions. In this way, cutting conditions can be approximately adapted for enhancing the NCD-coated tools performance.

About The Speaker

Dr. Stuart BARNES

Dr Stuart Barnes is Director of Research Degrees within WMG with responsibility for research programmes with in the order of 160 research students studying for EngD and PhD degrees in the UK and Hong Kong. He is a Chartered Engineer, a Fellow of the IOM3, a Member of the IET and currently President of the Birmingham Metallurgical Association. He joined WMG in 1992 and spent three years researching the conventional and laser machining of composite materials. After completing this research programme, Dr Barnes became involved in the development and delivery of MSc and doctorate programmes in the UK and the Far-East and spent four years on the Executive which managed the EngD programme. From 2002 to April 2013 he was Director of Professional and Executive Programmes with responsibility for part-time MSc and bespoke programmes for organisations such as AstraZeneca, BAE Systems and Network Rail as well as setting-up MSc programmes in Singapore and Kuala Lumpur. Prior to joining WMG he spent 13 years in industry with GKN Technology and NEI Thompson. Dr Barnes continues to be research active in the field of machining and has published over 50 journal/conference papers.

Involvement with Institute & Local Societies and Committees:

Honorary Secretary, Staffordshire Iron & Steel Institute	1989 - 1993
President, Staffordshire Iron & Steel Institute	1993 - 1994
Member, Loughborough University Court (IoM Representative)	1993 - 1998
Member, Council of Staffordshire Iron & Steel Institute	1989 - 2000
Chairman, Regional committee of the Institute of Materials	1993 - 1998
Member, Regional Affairs committee of the Institute of Materials	1995 - 1998
Member, Council of the Birmingham Metallurgical Association	2000 - present
Member/Chair, Professional Review Panels for the IMMM	1993 - present
President Birmingham Metallurgical Association	2013 - Present

ADVANCES IN CRYOGENIC AND ULTRASONIC ASSISTED MACHINING

The modern machine tool is virtually unrecognisable in terms of its physical appearance and technical capabilities compared to those which were in use only a few years ago. Developments such as high speed spindles, live tooling and multi-axis machining have been combined with advances in cutting tool design, materials and coatings plus enhancements in cutting fluid performance in order to achieve unprecedented improvements in productivity. However, the continual development of increasingly difficult-to-machine materials, combined with the ever present desire for further increases in productivity, continue to drive the evolution of machine tools and machining processes. This paper will consider two techniques which although they have been known about for some time, have recently matured to the point that they are demonstrating commercial potential for further improvements in conventional machining processes; cryogenic cooling and ultrasonic assisted machining.

Cryogenic cooling of the cutting tool or the cutting zone has the potential to remove the heat generated during machining more efficiently that conventional cutting fluid and various researchers have investigated a range of techniques over the years. However, this presentation will describe research at WMG using a commercially available system and consider the advantages / viability of the process.

Ultrasonic assisted machining is also a technique which has been known to have a positive effect on certain aspects of machining for some time with several laboratory scale set-ups being developed by researchers. However, the system which is being used at WMG is integral within a commercially available, fully functional, 5-axis machine tool provided by DMG Mori Seiki. The application of this commercially available implementation of the technology will be reviewed along with some of the research work performed using this facility.

ABSTRACTS

APPLICATION OF M METHOD AND CONSIDERATION OF MEASURES TO ADAPT FOR DIVERSE USERS (YM1)

Shuji KANAZAWA, *kshuji747@gmail.com* Graduate School of Keio University, 3-14-1, Hiyoshi, Yokohama, Kanagawa, Japan

Yuma SAKAE, *yuma.sakae0831@gmail.com* Keio University, 3-14-1, Hiyoshi, Yokohama, Kanagawa, Japan

Shuji TAKANO, *takano@md.shonan-it.ac.jp* Shonan Institute of Technology, 1-1-25, Tsujido Nishi Kaigan, Fujisawa, Kanagawa, Japan

Koichiro SATO, *k.sato@mech.keio.ac.jp* Keio University, 3-14-1, Hiyoshi, Yokohama, Kanagawa, Japan

Yoshiyuki MATSUOKA, *matsuoka@mech.keio.ac.jp* Keio University, 3-14-1, Hiyoshi, Yokohama, Kanagawa, Japan

ABSTRACT

This paper conducts an application of the M method in order to clarify issues needed to be improved. The M method is a design method which can realize both unrestricted thinking and logical thinking. By applying this method to varied users, such problems relating to the usability of the M method are extracted. Therefore, it is clarified that the M method needs to adapt to diverse users. Furthermore, measures to solve the clarified issues are discussed.

Keywords: M Method, Multispace Design Model

MULTISPACE QUALITY FUNCTION DEPLOYMENT USING DESIGN STRUCTURE MATRIX (YM2)

T. KATO, *t.kato@tokai-u.jp* Tokai University, 4-1-1 Kitakaname, Hiratsuka, Japan

T. SOGA, *0bem2215@mail.tokai-u.jp* Tokai University, 4-1-1 Kitakaname, Hiratsuka, Japan

Y. HOSHINO, *y-hoshino@mail.nissan.co.jp* Nissan Motor Company Ltd., 560-2 Okatsukoku Atsugi, Japan

ABSTRACT

Specialization and professionalization of design work make it difficult for members of a product development team to share product information each other. In the previous study, the Multispace Quality Function Deployment (M-QFD), which allows designers to extract design elements with respect to diverse requirements and enables them to understand their relationships, was proposed on the basis of the multispace design model and Interpretive Structural Modeling. This study improves the M-QFD using Design Structure Matrix. The proposed M-QFD enables them to construct a modular composition of the product components in the late process of design. Additionally, a design example (design of an automotive steering system) is presented to demonstrate the proposed M-QFD.

Keywords: Design theory and methodology, QFD, ISM, DSM

VALUE GROWTH MOBILITY BASED ON TIMEAXIS DESIGN (YM3)

Yuma. KUSUNOKI, zond@z7.keio.jp Keio University, 3-14-1, Hiyoshi, Kohoku-ku, Yokohama, Japan

Kei. KAMIYA, k.kamiya.0123@gmail.com Keio University, 3-14-1, Hiyoshi, Kohoku-ku, Yokohama, Japan

Akira. KITO, fa0kitou@hotmail.co.jp Keio University, 3-14-1, Hiyoshi, Kohoku-ku, Yokohama, Japan

Koichiro. SATO, k.sato@mech.keio.ac.jp Keio University, 3-14-1, Hiyoshi, Kohoku-ku, Yokohama, Japan

Yoshiyuki. MATSUOKA, matsuoka@mech.keio.ac.jp Keio University, 3-14-1, Hiyoshi, Kohoku-ku, Yokohama, Japan

ABSTRACT

This paper describes Value Growth Mobility based on Timeaxis Design. Timeaxis Design incorporates the viewpoint of time into the theory and methodology of design. We propose Value Growth Mobility including Core Module system and Service system which are realized by Timeaxis Design. Value Growth Mobility is able to adapt to users by Core Module system and Service system, and the value of the mobility grows as it is used. Finally, the effects by Value Growth Mobility to social problems such as global warming and energy problem are discussed.

Keywords: Value Growth Mobility, Timeaxis Design

CONCEPTUAL STRUCTURING OF MODULAR DESIGN METHODOLOGY FOR MECHATRONIC SYSTEMS: BEHAVIOUR BASED DESIGN PERSPECTIVE (YM4)

Zuhal ERDEN, *zuhal@atilim.edu.tr* Atılım University, 06836, Ankara, Turkey

ABSTRACT

In an ever increasing global marketplace, it is often vital for companies to diversify their product ranges to meet customers' changing needs. This requirement leads companies to adopt their product development strategy for mass customization. An important strategy for this purpose is to develop product families (platform-based modular products) and there is considerable amount of research on modularity for mechanical products. On the other hand, research on the conceptual structuring of modular mechatronic products (mechatronic product families) is quite limited. This paper presents a conceptual scheme for systematic design of platform-based mechatronic product families for mass customization. The purpose of the conceptual scheme is to generate a formal structure for defining modules of a mechatronic product family to perform intended operational behaviours during conceptual design. A state-based behavioral representation framework for a mechatronic system has been developed and implemented on a physical structure in a previous research. This paper introduces a conceptual structure of the modular mechatronic design methodology based on that framework. The applicability of the developed conceptual scheme is also explained using a descriptive example.

Keywords: product platform, mechatronic product architecture, mechatronic product family, modular mechatronic design, modular behaviour

PREGNANT OCCUPANT MODEL DESIGN TO IMPROVE SAFETY (SA1)

B. Serpil ACAR, B.S.Acar@Lboro.ac.uk, Design School, Loughborough University, UK.

Moustafa MERIC, M.Moustafa@Lboro.ac.uk, Design School, Loughborough University, UK.

Memis ACAR, M.Acar@Lboro.ac.uk, Wolfson School of Mechanical and Manufacturing Engineering, Loughborough University, UK.

ABSTRACT

Computational modelling is an effective way of estimating the risk of injuries and fatalities in road traffic accidents. Computational pregnant occupant modelling has an additional important role that is the investigation of the risk of fetus mortality in crash test simulations. In this paper, the effect of including the fetus in the uterus of the pregnant occupant model is investigated using the computational pregnant occupant model 'Expecting' in crash test simulations. First, isolated drop test simulations with and without a fetus are used to show the effect of presence of fetus in the uterus model are conducted and compared with earlier researchers' findings. Then the pregnant occupant model, 'Expecting', with varying levels of restraint system use, such as fully restrained, 'seatbelt only', 'airbag only' and 'no restraint', is used in the simulations of frontal crashes representing five levels of impacts. Maximum strains developed in the utero-placental interface with and without a fetus are compared in both cases. Both experiments predict higher risks of placental abruption when the fetus is included in the model. Simulations with the pregnant occupant model, 'Expecting', with and without a fetus, provides an opportunity to explore the role of inclusion of fetus in the uterus of the model.

Keywords: Pregnant, Occupant, Fetus, Crash, Safety, Modelling, Simulations.

A FEM-MB MIXED METHODOLOGY TO ANALYZE THE PASSIVE SAFETY PERFORMANCES OF A PASSENGER SEAT FOR RAILWAY USE (SA2)

Francesco Caputo, *francesco.caputo@unina2.it* Second University of Naples, 81031, Aversa, Italy

Giuseppe Lamanna, *giuseppe.lamanna@unina2.it* Second University of Naples, 81031, Aversa, Italy

ABSTRACT

The research activity showed in the present paper aims to identify a FEM-MB mixed numerical procedure to support the structural design of a passenger seat in railway field, in order to make it compliant with passive safety requirements. The passive safety performances of the seat as a whole is understood here as its capability to minimize, or even to avoid, any damage to passengers seated on it or on adjacent seats, through the use of appropriate design features, which should allow to absorb large amounts of impact energy.

Keywords: Biomechanics, Passenger Seat, Multibody

OPTIMIZATION STUDY ON MULTI-BODY VEHICLE-FRONT MODEL FOR PEDESTRIAN SAFETY (SA3)

Hariharan S. SUBRAMANIAN, *hariharan.s@mech.iitd.ac.in* Indian Institute of Technology Delhi, 110016, New Delhi, India

Anoop CHAWLA, *achawla64@gmail.com* Indian Institute of Technology Delhi, 110016, New Delhi, India

Sudipto MUKHERJEE, *sudipto@mech.iitd.ernet.in* Indian Institute of Technology Delhi, 110016, New Delhi, India

Dietmar GOEHLICH, *dietmar.goehlich@tu-berlin.de* Technische Universitaet Berlin, 10623, Berlin, Germany

ABSTRACT

The safety of vulnerable road users, namely pedestrians, in a road-crash scenario with automobiles remains as a vehicle design challenge. A multi-body simulation between pedestrian and vehicle in MADYMO was used to simulate a crash of vehicle front [14 parameters] against 4 different TNO pedestrian models [95th %le M, 50th %le M, 5th %le F, 6 Y.O. Child]. Pedestrian safety was measured using Weighted Injury Cost (WIC). A global optimization was performed using genetic algorithm in order to minimize WIC with geometric constraints on vehicle profile. Within known limitations, at least one pedestrian friendly vehicle shape not resembling any existing vehicle profile was found.

Keywords: Pedestrian safety, Injury Cost, vehicle front optimization, multi-body simulations, Genetic Algorithms

DESIGN CONCEPT FOR AN INTEGRATED WHIPLASH MITIGATING HEADRESTRAINTS AND CAR SEAT (SA4)

M. ACAR, *M.Acar@lboro.ac.uk*, Wolfson School of Mechanical and Manufacturing Engineering, Loughborough University, UK.

S.R. BEWSHER, *S.R.Bewsher-10@student.lboro.ac.uk*, Wolfson School of Mechanical and Manufacturing Engineering, Loughborough University, UK.

ABSTRACT

This paper presents design of a concept for an integrated headrestraint and car seat system to mitigate whiplash in rear-end vehicle collisions. The main emphasis is a concept, which combines a reactive headrestraint with a reactive seat. The chosen concept is developed in the form of mechanical linkages using SAM 6.1. A human model positioned in a 'good' driving posture is used to show how the headrestraint and seat would operate using a typical crash pulse used for dynamic sled testing of automotive seats. The headrestraint system is capable of translating into an optimal position of 40 mm forwards and 60 mm upwards in 12 ms, before whiplash induced injuries start to take place. The reactive seat is also capable of reclining 15 degrees. The combination of reducing the backset and reclining the seat to reduce the relative motion between the head and torso has the potential to reduce the whiplash effect related injuries in rear-end collisions.

Keywords: whiplash, headrestraint, occupant seat

STRUCTURAL CRASHWORTHINESS ANALYSIS OF A PICKUP TRUCK SUBJECTED TO POLE SIDE IMPACTS (SA5)

M. Ozan KOCABAŞ, m.ozankocabas@hotmail.com Middle East Technical University – Northern Cyprus Campus, Kalkanlı, Güzelyurt, KKTC, Mersin 10, Turkey
Eren ÜNSAL, erenunsal1@gmail.com Middle East Technical University – Northern Cyprus Campus, Kalkanlı, Güzelyurt, KKTC, Mersin 10, Turkey
Volkan ESAT, evolkan@metu.edu.tr Middle East Technical University – Northern Cyprus Campus, Kalkanlı, Güzelyurt, KKTC, Mersin 10, Turkey

ABSTRACT

Crashworthiness of an automobile body in side impacts depends not only on the chassis geometry and topology, but also on the design and reliability of other structural members such as B-pillar and side panels. Side impacts vary with respect to the crash partner. Barrier side impact tests are used to reconstruct vehicle-to-vehicle collisions, at least one of which is impacted laterally; whereas pole side impact test is employed to investigate an arguably more hazardous condition, where the pole impacted is stationary, possibly causing severe localized damage on the body of the vehicle. This study focuses on investigating the effects of pole side impacts on the crashworthiness of a pickup truck with a ladder frame chassis. Previous research work concentrate on the particular aspects of the structure of the vehicle to improve crash energy absorption characteristics. In this study, a finite element (FE) model is developed utilising a previously generated mesh of a pickup truck. The FE model is employed to simulate pole side crash test scenarios on the whole body of the vehicle. Total strain energies sustained by the vehicle, pole reaction forces, and equivalent von Mises stresses are presented for several proposed design

improvements in order to enhance crashworthiness. Computational results yield good agreement with experimental findings.

Keywords: Crashworthiness, Crash energy, Finite element analysis, Pole side impact

CRASHWORTHINESS OF CUARDRAIL POST EMBEDED IN COHESIONLESS SOIL (SA6)

Sassi ABDELMONAAM, *sassi@uwindsor.ca*, University of Windsor, Department of Civil and Environmental Engineering, Windsor, On, N9B3P4, Canada

Faouzi GHRIB, *fghrib@uwindsor.ca,* University of Windsor, Department of Civil and Environmental Engineering, Windsor, On, N9B3P4, Canada

ABSTRACT

The purpose of this paper is to conduct a parametric analysis of the crashworthiness of W-beams posts. The evaluation of guardrail post's performance usually involves crash tests which consist of colliding the post with a bogie. Crashworthiness tests try to cover a range of design parameters such as the soil resistance, impact velocity and blockout crushability. When reviewing the existing various dynamic tests conducted to-date, it is apparent that the range of the considered design parameters varies widely. Because of the lack of consistency of the various test conditions, the statistical analysis of the test results is not an easy task. In this paper, the finite element method has been employed as the main tool to conduct the parametric study and generate the statistical data. A finite element model of a typical guardrail post has been developed and calibrated with the results of an impact test. A series of correlations between the different design parameters and the post reaction is established.

Keywords: Guardrail post, dynamic test, Finite Element Model, Cohesionless soil

EFFECTS OF CHASSIS GEOMETRY ON STRUCTURAL CRASHWORTHINESS OF A PICKUP TRUCK IN FULL-FRONTAL IMPACTS (SA7)

Semih DAĞDEVİREN, smhdagdeviren@gmail.com Arçelik A.Ş. –Washing Machines Divison, Altınordu Cad., No: 3, Organize Sanayi Bölgesi, Sincan, 06930, Ankara, Turkey

Mecit YAVUZ, mecityavuz@windowslive.com Arçelik A.Ş. –Directorate of Consumer Support & Spare Parts, Çayırova Campus, Tuzla, 34950, İstanbul, Turkey

Volkan ESAT, evolkan@metu.edu.tr Middle East Technical University – Northern Cyprus Campus, Kalkanlı, Güzelyurt, KKTC, Mersin 10, Turkey

ABSTRACT

Automobile chassis is a major element of structural crashworthiness in road motor vehicles. Various chassis geometry and topology research studies have been conducted to improve crash energy absorption characteristics of the chassis. This study aims to contribute to the investigations on the effects of chassis geometry over crashworthiness, particularly focusing on the structure of a ladder frame chassis subjected to full-frontal collisions. Preliminary work has been conducted to evaluate the behaviour of steel beam profiles under impact loading through finite element (FE) modelling, which helps understand the mechanics of the particular beams chosen as chassis elements. Another finite element (FE) model is developed utilising a previously generated mesh of a pickup truck. The FE model is employed to simulate full-frontal crash test scenarios on the isolated chassis as well as on the whole body of the vehicle. Crash energy absorption results and reaction forces are collected for different

thicknesses and beam profile cross sections of the vehicle chassis. Computational results exhibit good agreement with experimental findings.

Keywords: Chassis geometry, Crashworthiness, Crash energy, Finite element analysis, Full- frontal impact

HYBRID RFID SYSTEM FOR DRIVER ASSISTANT AND ACTIVE ROAD ACCIDENT PREVENTION (SA8)

Huanjia YANG, *H.Yang@lboro.ac.uk* Loughborough University, Loughborough, UK
Shuang-hua YANG, S.*H.Yang@lboro.ac.uk* Loughborough University, Loughborough, UK

ABSTRACT

Driver error and reaction is one of the major causes of road accidents, and having an in-vehicle driver behaviour warning system can help to prevent a significant number of road accidents. However, current technologies struggle to provide satisfactory performance for the underlying data transmission/sharing layer. In this paper we first identify the primary contributing factors to road accidents and analyse the data transmission/sharing required for tackling them based on the study of historical accident records. We then investigate the feasibility of adopting various RFID technologies as the underlying technology to address those requirements in order to support active accident prevention. Our work demonstrated the effectiveness of RFID technologies in retrieving information from roadside and other vehicles and providing reliable and affordable solutions for integrations in future driver warning systems or autonomous vehicle control systems.

Keywords: RFID, Data transmission, Driver assistant, Active prevention

SHAPE OPTIMIZATION OF 2D RUBBER BUSHING USING DIFFERENTIAL EVOLUTION ALGORITHM (EA1)

Necmettin KAYA, *necmi@uludag.edu.tr,* Uludağ University, Mechanical Engineering

ABSTRACT

The objective of this study is to design rubber bushing at desired level of stiffness characteristics in order to achieve the structural stability. A differential evolution algorithm based approach is developed to optimize the rubber bushing through integrating a finite element code running in batch mode to compute the objective function values for each generation. Two case studies were given to illustrate the application of proposed approach. Optimum shape parameters of 2D bushing model are determined by shape optimization using differential evolution algorithm.

Keywords: Shape optimization, differential evolution, rubber bushing, static stiffness curve

STRUCTURAL OPTIMIZATION OF BLADE – DISC FIRTREE ATTACHMENT OF AN AERO-ENGINE (EA2)

Erdem ACAR, *acar@etu.edu.tr* TOBB University of Economics & Technology, 06560, Ankara, Turkey

Mutlu GÜNDÜZ, *mutlu.gunduz@tei.com.tr* TEI Tusas Engine Industries, 26003, Eskisehir, Turkey

ABSTRACT

This study describes design and optimization of turbine blade-disc attachment known as firtree attachment. Objective of the optimization is to minimize total mass of blade-disc firtree region while keeping attachment stresses below the material strength limits. Meta modeling techniques are used to identify the relations between geometrical parameters and stresses. Three different metamodeling techniques are employed in this study: polynomial response surface approximations (PRS), radial basis functions (RBF) and Kriging (KRG). Optimization of the firtree attachment is performed using these three metamodels, and three different optimum candidates are obtained for each metamodeling technique. Finally, numerical validations of optimum candidates are performed using finite element analysis.

Keywords: Blade-disk firtree attachment, Structural design, Optimization, Meta model

DEVELOPMENT OF NEW CRASH BOXES FOR AUTOMOTIVE INDUSTRY (EA3)

Emre DEMİRCİ, *emre.demirci@btu.edu.tr*, Bursa Teknik Üniversitesi, 16190, Bursa

Ali Rıza YILDIZ, *aliriza.yildiz@btu.edu.tr*, Bursa Teknik Üniversitesi, 16190, Bursa

Fehim SEMERCİ, *fsemerci@toksanotomotiv.com*, Toksan R&D Center, Bursa

ABSTRACT

Nowadays, a lot of research works have been conducted in the field of crashworthiness in order to define crash performance of vehicles and crash boxes. In this study, new crash box designs are developed for frontal impact of vehicles. Numerical studies include determination of energy absorption characteristics of different geometries of crash boxes. In addition, these studies include making changes in existing profiles with wall thickness of crash boxes, changing the positions of some of the profiles and adding new profiles.

Keywords: Crash box, Frontal Impact, Vehicle design

INVESTIGATING THE EFFECTS OF VARIABLE FEED RATE ON TOOL LIFE IN TURNING (MD11)

Ali ORAL, *alioral@balikesir.edu.tr* Balikesir University, 10145 Balikesir, Turkey

M. Cemal ÇAKIR, *cemal@uludag.edu.tr* Uludag University, 16100 Bursa, Turkey

Demet GÖNEN, *dgonen@balikesir.edu.tr* Balikesir University, 10145 Balikesir, Turkey

A. Deniz KARAOĞLAN, *deniz@balikesir.edu.tr* Balikesir University, 10145 Balikesir, Turkey

ABSTRACT

The life of a tool is affected by many factors such as cutting speed, depth of cut, chip thickness, tool geometry, workpiece material or the cutting fluid and rigidity of machine tool. In this paper, an innovative turning strategy, variable feed turning, was introduced and a thorough investigation has been carried out to study the effect of gradual feed rate on tool life at constant depth of cut and cutting speed with no cooling fluid. Turning experiments with both constant and variable feed rates were conducted and comparisons were made to show the significant influence of variable feed rate. Feed rate was increased twice gradually in every millimeter at the beginning of turning and kept constant for the rest of the cut. Apart from the reduction in initial wear, the new turning strategy produced very successful results regarding the tool wear in moderate wear zone and considerable increase of 42% in tool life was achieved. Besides, the new strategy provided a longer tool life (upto 47% increase) along the entire life of tool.

Keywords: Tool life, Initial wear, variable feed rate

EXPERIMENTAL INVESTIGATION OF DOUBLE POINT ANGLE POLYCRYSTALLINE DIAMOND DRILL GEOMETRIES (MD12)

Yiğit KARPAT, *ykarpat@bilkent.edu.tr* Bilkent University, 06800, Ankara, Turkey

Onur BAHTİYAR, *obahtiyar@tai.com.tr* TUSAŞ-Turkish Aerospace Industries, Ankara, Turkey

ABSTRACT

Carbon fiber reinforced plastics (CFRPs) possess desirable material properties that make them preferable for the aerospace industry such as high strength to weight ratio, high resistance to corrosion, and low thermal expansion. Drilling of CFRPs has been studied extensively in the literature in recent years, where the influence of process parameters and drill geometry on delamination and tool wear were considered. In this study, three different double point angle polycrystalline diamond (PCD) drills were investigated using a mechanistic approach where the goal is to reveal the influence of drill geometry on the drilling forces and torques and delamination. A generalized drilling force and torque model for double point angle PCD drills is proposed and validated with experiment data. It is shown that proposed model can be used in drill design optimization studies.

Keywords: Machining, Drilling, Carbon fiber reinforced plastics, Polycrystalline Diamond

EXPERIMENTAL INVESTIGATION OF CGI DRILLING ADAPTED WITH EXTERNAL MQL SYSTEM

A. Taner KUZU, *kuzua@itu.edu.tr* Istanbul Technical University, 34437, Istanbul, Turkey

U. Alican ALMA, *alma@boun.edu.tr,* Boğaziçi University, 34342, Istanbul, Turkey

Kaveh RAHIMZADEH BERENJI, *rahimzadehberen@itu.edu.tr* Istanbul Technical University, 34437, Istanbul, Turkey

Mustafa BAKKAL, *bakkalmu@itu.edu.tr* Istanbul Technical University, 34437, Istanbul, Turkey

ABSTRACT

As automotive industry tries to meet the expectations of the user demands for a long time, they also try to respond the scope of expanding environmental protection laws. Because of the low emission laws, engine designers are forced to improve technology in order to have more effective combustion process in engines. For this purpose CGI is used instead of gray cast iron due to the higher mechanical properties, corrosion and wear resistance. Thus it provides more efficient combustion environment. Moreover, in recent years, MQL attracted researchers' attention due to its eco-friendly and cost wise efficiency properties. Besides these advantageous, MQL can enhance the machining performance. Therefore, during drilling operation MQL systems have been used for lubrication, cooling and chip removal aspects. Throughout the study over and above, the proper cutting parameters were determined for a longer tool life and efficient machinability with MQL.

Keywords: CGI drilling, MQL, Wear

PERFORMANCE OF NOVEL α/β-SiAlON-TiN CERAMIC COMPOSITES ON HIGH SPEED MILLING OF INCONEL 625 (MD14)

Ali ÇELİK, acelik1@anadolu.edu.tr MDA Advanced Ceramics Ltd., 26110, Eskisehir, Turkey

Melike SERT ALAGAÇ, msert@alp.com.tr Alp Aviation Co., 26110, Eskisehir, Turkey

Uğur Evrensel YILMAZ, uyilmaz@alp.com.tr Alp Aviation Co., 26110, Eskisehir, Turkey

Alpagut KARA, akara@anadolu.edu.tr Anadolu University, Department of Materials Science and Engineering, 26480, Eskisehir, Turkey.

Servet TURAN, sturan@anadolu.edu.tr Anadolu University, Department of Materials Science and Engineering, 26480, Eskisehir, Turkey.

Ferhat KARA, fkara@anadolu.edu.tr Anadolu University, Department of Materials Science and Engineering, 26480, Eskisehir, Turkey.

ABSTRACT

In this study, aim was to produce a novel α/β-SiAlON-TiN ceramic milling cutter and to investigate its performance on high speed machining of Inconel 625 superalloy. Micro-chipping was found to be the main wear mechanism at the early stage of the cutting where the temperature is lower than the softening temperature of the Inconel part. After a few revolution in contact with the work-piece, the wear mode turned into diffusion dominant due to the increase in temperature above 1000°C. Despite the fact that the mechanical properties was improved by the addition of TiN, it reduces the chemical stability of the ceramic at aggressive machining conditions (T>1000°C).

Keywords: SiAlON, milling, superalloys, diffusion wear

HIGH EFFICIENCY ELLIPTICAL VIBRATION CUTTING OF HARDENED STEEL WITH LARGE NOSE RADIUS SINGLE CRYSTAL DIAMOND TOOL (MD15)

Yilong WANG, *wang@upr.mech.nagoya-u.ac.jp* Nagoya University, 464-8603, Nagoya, Japan

Eiji SHAMOTO, *shamoto@mech.nagoya-u.ac.jp* Nagoya University, 464-8603, Nagoya, Japan

ABSTRACT

Elliptical Vibration Cutting of hardened steel with large nose radius single crystal diamond tool is proposed in this paper. Experimental findings revealed that the proposed machining method has great potential to realize the high efficiency ultra-precision diamond machining of steel. However, it was found that ploughing phenomenon significantly affects the finished surface quality. An analytical model was developed for the optimization of machining conditions to minimize the ploughing effect. The analytical model was then validated in a qualitative manner with experimental tests using steel workpieces.

Keywords: Elliptical Vibration Cutting, Hardened steel, Single crystal diamond tool, Minimum uncut chip thickness

VERIFICATION OF CONE FRUSTUM ACCURACY TEST OF FIVE-AXIS MACHINING CENTER (MD21)

Toru TAJIMA, *m1m13412@st.oit.ac.jp* Osaka Institute of Technology, 535-8585, Osaka, Japan

Tomohiro KUBO, *e140057@st.oit.ac.jp* Osaka Institute of Technology, 535-8585, Osaka, Japan

Yukitoshi IHARA, *ihara@med.oit.ac.jp* Osaka Institute of Technology, 535-8585, Osaka, Japan

ABSTRACT

The motion accuracy evaluation method of five-axis machining centers (5-axis MC) is not fixed enough though their demand has increased now. There is NAS979 made as National Aerospace Standard in 1969 for an accuracy test method, and the cone frustum cutting test by endmill exists. However, this method assumes large scale 5-axis MCs for making aircraft parts with rotary axes on the spindle side, and then it is necessary to misinterpret the test method suitably to apply for a lot of 5-axis MC. Nevertheless, it is still used because there is no other test method of five-axis machining center that takes the place of NAS979. The discussion about the ISO standard concerning the accuracy test method of 5-axis MC started in 2006. In the discussion, the cone frustum cutting test in NAS979 is improved as five-axis simultaneous interpolation motion described in ISO10791-7 “Accuracy of a finished test piece”, and similar test using ball bar is also described in ISO10791-6 “Accuracy of interpolation motion test”. These two standards are DIS stage in 2013, and they are scheduled to be issued as International Standards by the end of 2014. In this report, the cone frustum tests that are scheduled to be adopted for ISO10791-6 and

ISO10791-7 are outlined. Next, the results of the accuracy test of interpolation motion by the ball bar that are actually measured on several 5-axis MCs are shown, and the kind of error source of the machine appeared with this test method is also shown. Moreover, the feasibility of the evaluation test method is discussed. In addition, the offset of the rotary axes that is mainly caused by the thermal deformation and that is appeared to the measurement results is discussed.

Keywords: Five-axis machining center, Motion accuracy, Test standard, Ball bar

EFFECT OF JOINT STIFFNESS ON THE DYNAMIC PERFORMANCE OF THE MACINE TOOL (MD22)

Chih CHUNG, *Faby FENG, faby@g-tech-inst.com*, G-TECH Instrument, Taichung, Taiwan (R.O.C.)

Robert J. BENJAMIN, *bob@benstone.com*, Benstone Instrument, St. Paul, Minnesota, USA

ABSTRACT

Machine Tool performance has many influencing factors from feed rate, spindle rotation, various system that turn on and off during the machining operation, thermal coefficients, and the stiffness of the machine tool and more. Joint stiffness is one factor that is typically overlooked in evaluating the performance of machine tools. This paper presents the effect of the joint stiffness on the dynamic performance of the machine tool by using the frequency response function (FRF) of the tool-spindle system, structure, and measurement of vibration (power spectrum) during heavy milling, and analysis using the stability lobe diagrams (SLD). These methods of measurement show how non-uniformed scraped surfaces and improper threaded holes are the cause for weak joint stiffness and poor machine tool performance.

Keywords: Milling, Chatter, Modal analysis, Joint stiffness, Scraping

THE EFFECT OF TOOL ORIENTATION ON FIVE AXIS BALL END MILLING OF Ti6Al4V (MD23)

S. Ehsan Layegh K., *slayegh@ku.edu.tr* Koc University, 34450, Istanbul, Turkey

I. E. Yigit, *iyigit13@ku.edu.tr* Koc University, 34450, Istanbul, Turkey

Ismail Lazoglu, *ilazoglu@ku.edu.tr* Koc University, 34450, Istanbul, Turkey

ABSTRACT

Five-axis sculptured surface milling is one of the most common machining processes in high-tech industries such as aerospace, automotive, and biomedical industries. Lead and Tilt angles are among the parameters that critically influence the efficiency of five axis milling in many respects, e.g., dissipated energy in cutting, tool deflection, and surface quality. Up to now, most of the investigations on the effects of lead and tilt angles are regarded to consider the geometrical optimization and gouge–free machining only. Effects of lead and tilt angles on mechanics of the process and dissipated energy have been studied very little. In this paper, firstly the process of five-axis sculptured surface milling is mechanically modeled. Then for the same removed material volume, the effects of lead and tilt angle on the cutting forces are investigated. It will be shown that by selecting the appropriate lead and tilt angles resultant cutting force and the force component perpendicular to the machined surface can be reduced in an optimum way. Finally, the simulation result are validated with the conducted experimental tests.

Keywords: 5-axis milling, Lead and tilt angle, Optimization

A STUDY OF A POSTPROCESSOR SYSTEM FOR A HYBRID PARALLEL-SERIAL FIVE-AXIS MACHINE TOOL (MD24)

Yuan-Lung Lai, *lyllaiber@cc.ncue.edu.tw,* Department of Industrial Education and Technology, National Changhua University of Education, Changhua, Taiwan, R.O.C.
Hsiao-Ying Chan, *gm30121@outlook.com,* Department of Industrial Education and Technology, National Changhua University of Education, Changhua, Taiwan, R.O.C.
Tzuo-Liang Lo, *TzuoLiangLo@itri.org.tw*, Intelligent Machine Tool Technology Center, Industrial Technology Research Institute, Taichung, Taiwan, R.O.C.

ABSTRACT

This paper proposes a general postprocessor initially aimed to translate CC path for CNC controllers. Five-axis machine tools have become the most important role in modern production systems. The complicate frames of the machine tools lead to an inaccuracy at the tool tip caused by kinematics parameter deviation resulting from manufacturing errors, assembly errors or quasi-static errors. The rotary axis in a common 5-axis machine tool is driven by a single motor that holds the platform for the axial rotation. However, with different weights of work pieces and the motor loaded, the rotating speed should be in reverse proportion to the weight. As a result, the axis-to-axis synchronization is poor, resulting in dramatic decrease in machining precision. Therefore, a 2PRP planar parallel platform is designed by connecting the two PRP connectors and moving table with a round bar. The motor drives ball screws and propels these PRP connectors. The two parallel ball screws acquire both effects on movement or rotation by generating different displacements of these two connectors. Thus the simulation of the rotating table on a 5-axis machine tool is achieved. In order to explore the error origins of these machine tools it is necessary to have a suitable

mathematical model of the machine tools. The model can be not only used for developing postprocessors but also compensating the errors mentioned previously. The diagnosed errors could be taken under consideration only by the precise description of the actual kinematics of the machine tools.

Keywords: Five-axis, D-H transformation matrix, Kinematic model, Postprocessor.

MODELLING OF TURN MILLING PROCESSES FOR INCREASED PRODUCTIVITY (MD25)

Umut KARAGÜZEL, *karaguzelu@itu.edu.tr* Istanbul Technical University, Istanbul, Turkey

Emre UYSAL, *emreuysal@sabanciuniv.edu* Sabanci University, Istanbul, Turkey

Erhan BUDAK, *ebudak@sabanciuniv.edu* Sabanci University, Istanbul, Turkey

Mustafa BAKKAL *bakkalmu@itu.edu.tr* Istanbul Technical University, Istanbul, Turkey

ABSTRACT

This paper presents mathematical models and experimental data for the turn milling process which combines conventional turning and milling. Turning with a milling tool offers the advantage of intermittent cutting which allows higher productivity by increased cutting speeds and improved tool life. In this paper, models for turn milling process geometry and chip formation including eccentricity effects are presented. Furthermore, circularity, cusp height and surface roughness are investigated, and cutting forces are simulated. Predictions are verified by experimental results. Tool wear tests performed on hard-to-machine materials to demonstrate substantially increased tool life in turn milling.

Keywords: Modelling, Wear, Turn Milling

MECHATRONIC SPINDLE HEAD FOR CHATTER SUPPRESSION IN HEAVY DUTY OPERATIONS (MD31)

Iker MANCISIDOR, *imancisidor@ideko.es,* IK4-IDEKO, DanobatGroup, Elgoibar, Basque Country, Spain

Jokin MUNOA, *jmunoa@ideko.es,* IK4-IDEKO, DanobatGroup, Elgoibar, Basque Country, Spain

Rafael BARCENA, *rafa.barcena@ehu.es*, University of the Basque Country (UPV-EHU), Bilbao, Basque Country, Spain.

Xabier MENDIZABAL, *xmendizabal@soraluce.com,* Soraluce, DanobatGroup, Bergara, Basque Country, Spain

ABSTRACT

A new concept of spindle head for heavy roughing operations has been developed integrating an inertial actuator and an accelerometers in a heavy duty spindle head. With this head is possible to introduce active damping using the inertial drive, and improve the dynamic stability of the machine. A novel mechatronic milling model is employed for designing the actuator, where the effect of cutting process and inertial actuators can be simulated. The validation tests of the new actuator are shown and all mechatronic system is completely integrated on the machine. Finally, experimental cutting tests are performed, showing that material removal rate is doubled with this new spindle head.

Keywords: Stability, Milling, Chatter, Active Control.

INFLUENCE OF THE SPACER CLEARANCE ON THE DYNAMIC CHARACTERISTICS OF A SPINDLE TOOL (MD32)

Jui-Pin Hung, *hungjp@ncut.edu.tw,* Institute of Precision Manufacturing, National Chin-Yi University of Technology, Taichung, Taiwan, R.O.C.

Kung-Da Wu, *ffi85236@hotmail.com,* Department of Mechanical Engineering, National Chin-Yi University of Technology, Taichung, Taiwan, R.O.C.

Chun-Wei Lin, *oo781114@yahoo.com.tw, Departme*nt of Mechanical Engineering, National Chin-Yi University of Technology, Taichung, Taiwan, R.O.C.

Bing-Jie Peng, *posa.posa@msa.hinet.net,* POSA Precision Spindle Co., Ltd., Taichung, Taiwan, R.O.C.

ABSTRACT

This study was aimed to identify the influence of the spacer clearance on the dynamic characteristics of a spindle tool through the finite element and experimental approaches. The correlations between the spacer clearance and modal parameters were first examined by conducting vibration tests on physical spindle units. Experimental measurements show that the dynamic stiffness and damping ratio associated with the dominating modes were affected to vary negatively with bearing preload. When the spacer clearance was adjusted from 2 to 32 μm, the bearing preload increased from 73 to 636 N. This in turn enhances the bearing stiffness and natural frequency of the spindle unit, but the dynamic compliance was found to increase from 0.217 to 0.452 μm/N. Besides, comparisons of simulations and experimental measurements clearly show the accuracy of the finite element modeling of a spindle tool unit presented in this study. It is believed that the developed analysis model associated with the experimental measurements on the preloading spacer can

help the machine tool designer to accurately simulate and optimize the machining performance of the machine tool at design stage.

Keywords: Bearing preload, Dynamic compliance, Spacer clearance.

COMPARISON OF DAMPING PROPERTIES OF SPINDLE BEARINGS (MD33)

C. BRECHER, c.*brecher@wzl.rwth-aachen.de* Laboratory for Machine Tools and Production Engineering, 52074, Aachen, Germany

M. FEY, m.*fey@wzl.rwth-aachen.de* Laboratory for Machine Tools and Production Engineering, 52074, Aachen, Germany

R. HABERMANN, *r.habermann@wzl.rwth-aachen.de* Laboratory for Machine Tools and Production Engineering, 52074, Aachen, Germany

ABSTRACT

The calculation of frequency response functions for machine tools helps to predict the dynamic behavior during the design phase of machine tools. While the calculation of static stiffness and eigen frequencies can be considered state of the art, the prediction of damping ratios is not possible without detailed damping models. This paper determines and compares local damping properties of spindle bearing packages of a single size but different physical properties for three preload classes. A simulation model is used to isolate the test bench damping. The validity of two different damping models is studied under changed dynamic boundary conditions.

Keywords: Manuscripts, Preparation guide

ACTIVE DAMPING OF HEAVY DUTY MILLING OPERATIONS (MD34)

Robin Kleinwort, *Robin.Kleinwort@iwb.de* Technische Universitaet Muenchen, Germany

Yusuf Altintas, A*ltintas@mail.ubc.ca* University of British Columbia, Vancouver, Canada

Michael F. Zaeh, *Michael.Zaeh@iwb.de* Technische Universitaet Muenchen, Germany

ABSTRACT

The material removal rate of a machine tool is often restricted by its chatter stability limits. If the axial depth of cut is too high, the cutting process becomes unstable and chatter vibrations occur. The critical depth of cut can be increased using active methods to damp the structural modes which cause chatter. In this paper a methodology is introduced on how to implement an active damping system on milling machines to improve their productivity. A new control strategy for active damping is presented, which was tested on a commercial milling machine. It is demonstrated experimentally that 33% productivity increase has been achieved with the proposed method.

Keywords: Active damping, Chatter, Stability, Milling

A MODEL OF TOOL POINT DYNAMICS CONSIDERING EFFECTS OF BI-DISTRIBUTED JOINT INTERFACES (MD35)

Yun YANG, *yunyang@mail.nwpu.edu.cn* Northwestern Polytechnical University, 710072 Xi'An, P.R. China

Min WAN, *m.wan@nwpu.edu.cn* Northwestern Polytechnical University, 710072 Xi'An, P.R. China

Weihong ZHANG, *zhangwh@nwpu.edu.cn* Northwestern Polytechnical University, 710072 Xi'An, P.R. China

ABSTRACT

This paper investigates the dynamics of cutting tool point by modeling tool-collet and collet-holder joint interfaces as two zero-thickness damped-elastic layers with variant stiffness along the cutter's axis. The tool-collet assembly is considered to rest on the resilient support provided by the spindle-holder assembly. Dynamics of the tool and the collet was modeled using Euler-Bernoulli beam theory. Properties of the joint interfaces were identified by minimizing the difference between the measured and predicted frequency response functions. Tool point dynamics of tool mounted in different holders was predicted by the proposed model. Experimental results showed that the model is valid for different spindle-holder-tool combinations.

Keywords: Tool point dynamics, Frequency response function (FRF), Receptance coupling, Euler-Bernoulli beam, Stability lobe diagram

MECHANICS AND DYNAMICS OF MULTI-FUNCTIONAL TOOLS (MD41)

Min WAN, *m.wan@nwpu.edu.cn*, School of Mechanical Engineering, Northwestern Polytechnical University, 710072 Xi'An, Shaanxi, People's Republic of China.

Z. Murat KILIÇ, *kilic@alumni.ubc.ca,* Manufacturing Automation Laboratory, University of British Columbia, V6T1Z4, Vancouver, Canada

Yusuf ALTINTAŞ, *altintas@mech.ubc.ca,* Manufacturing Automation Laboratory, University of British Columbia, V6T1Z4, Vancouver, Canada

ABSTRACT

The multi-functional tools are frequently used in the industry because of their advantage of combining drilling, boring and chamfering holes in one operation. In this study, we developed a mechanics/dynamics model to predict cutting forces and torque, and stability of the operation. General cutting mechanics is applied to analytically predict the oblique cutting forces along the arbitrary cutting edge of the cutter. The regenerative effect of lateral and torsional/axial vibrations is included in the model. Dynamic chip thickness is modeled with multiple delays due to distribution of cutting edges on the cutter body. The lateral and torsional/axial chatter stability of the complete hole making operation is simulated in semi-discrete time domain. The proposed static cutting force and chatter stability prediction models are experimentally validated with a multi-functional tool for drilling Aluminum Al7050.

Keywords: Chatter; multi-functional tools; multiple delays; cutting force

THE MECHANICS OF DOUBLE-SIDED MILLING OPERATION (MD42)

Z. Murat KILIÇ, *kilic@alumni.ubc.ca,* Manufacturing Automation Laboratory, University of British Columbia, V6T1Z4, Vancouver, Canada

Yusuf ALTINTAŞ, *altintas@mech.ubc.ca,* Manufacturing Automation Laboratory, University of British Columbia, V6T1Z4, Vancouver, Canada

ABSTRACT

Double-sided milling operations are becoming more popular for producing guides for elevator rails, railways and drives of machine tools. Traditional single-sided milling application may cause problem due to deflection of flexible workpiece. One solution to that is to have zero net force in axial direction of the cutter. Thus, double-sided milling can be applied to have equal forces from both sides of flexible workpiece. This paper introduces the mechanics model for the double-sided milling operation. Cutting forces are predicted using a general milling model. Cutting coefficients are calculated using material database. The model is validated through experiments. Predicted cutting forces are within 11% accuracy, and forces in axial direction are reduced significantly.

Keywords: Cutting forces, double-sided milling, parallel milling.

WORKPIECE SURFACE BURN DETECTION BY FORCE AND TEMPERATURE MODELING FOR GRINDING OPERATIONS (MD43)

Deniz ASLAN, *denizaslan@sabanciuniv.edu*, Manufacturing Research Laboratory, Sabanci University, 34956, Istanbul, Turkey

Erhan BUDAK, *ebudak@sabanciuniv.edu*, Manufacturing Research Laboratory, Sabanci University, 34956, Istanbul, Turkey

ABSTRACT

This paper presents a methodology to detect whether grinding temperatures will cause a surface burn over workpiece material or not by process modeling. Based on the triangular heat flux model, grinding wheel is represented as a moving heat source along the surface where the heat distribution over workpiece is investigated. Predicted temperatures are experimentally validated by using the measurements from the embedded thermocouples in the workpiece. In addition, using the previously developed semi-analytical grinding force model, the calculated shear stress and shear angle per abrasive grits are used in the primary and secondary zone energy equations in order to determine the chip temperatures. When the burning of the workpiece is initiated, there is a trend of growth of metallic particle adhesion in the abrasive grains of the wheel, having as consequence the increase of the grinding forces which agrees with the visible burn threshold as well. In this study, both force monitoring and visual inspection are used to detect surface burn and burn threshold results agree with the literature. Predicted and measured temperatures agree within approximately 11-14%, hence surface burn occurrence can be predicted by the presented model with an acceptable level of confidence.

Keywords: Surface Grinding, Force Model, Temperature Model, Surface Burn

FORCE MODEL FOR MICRO MILLING OF FREE FORM SURFACES (MD44)

Ali MAMEDOV, *amamedov@ku.edu.tr*, Koç University, 34450, Istanbul, Turkey

İ. E. YİĞİT, iyigit13@*ku.edu.tr*, Koç University, 34450, Istanbul, Turkey

Ismail LAZOĞLU, ilazoglu@*ku.edu.tr*, Koç University, 34450, Istanbul, Turkey

ABSTRACT

This paper presents a new model for estimating instantaneous machining forces with shearing and plowing mechanisms in micro ball end milling of free form surfaces. The analysis of cutting forces in micro milling plays an important role for the investigation of mechanics and dynamics of the cutting process. Force analysis is preliminary step to estimate the surface quality of machined miniature parts. Presented force model calculates instantaneous chip thickness by considering trajectory of the tool tip while tool rotates and moves ahead continuously. The model also takes into consideration the plowing force component which is important in micro milling and relates it to elastic recovery based on interference volume between micro tool and workpiece. The mathematical model is used to determine the force distribution on the micro milling tools. Presented force model is validated on Ti-6Al-4V grade Titanium Alloy, through micro ball end milling experiments for a wide range of cutting conditions using micro dynamometer.

Keywords: Micro milling; force model; Titanium Ti-6Al-4V;

SINGLE GRIT SCRATCH TESTS TO EXPLORE THE MATERIAL REMOVAL MECHANISM IN GRINDING AT MICRO SCALE (MD45)

Tahsin T. ÖPÖZ, *t.t.opoz@ljmu.ac.uk* Liverpool John Moores University, L3 3AF, Liverpool, UK

Xun CHEN, *x.chen@ljmu.ac.uk* Liverpool John Moores University, L3 3AF, Liverpool, UK

ABSTRACT

This paper presents the material removal mechanism in relation to the pile up ratio of material removal and the change of a grit cutting edge during single grit grinding. Investigation was carried out by utilizing single grit scratch tests on Inconel 718 material with a CBN grit of 40/50 mesh size. The concept of pile up ratio was introduced to determine material removal behaviour considering ploughing and cutting actions. The pile up ratio was calculated at the cross sections of scratches with various depths of cut and also along a scratch path to show the longitudinal behaviour of the material removal. The experimental results showed that material removal mechanism during single grit action was highly dependent on the shape change of grit cutting edge and the depth of cut.

Keywords: Single grit scratch, Grinding, Pile up ratio, Material removal, Inconel 718

A DECISION SUPPORT SYSTEM FOR SELECTION OF BIO-MATERIALS (48)

M. Alper SOFUOGLU, *asofuoglu@ogu.edu.tr*, Eskisehir Osmangazi University, 26480 Eskisehir, Turkey

Sezan ORAK, *sorak@ogu.edu.tr,* Eskisehir Osmangazi University, 26480 Eskisehir, Turkey

ABSTRACT

With the availability of more various materials, selecting the most suitable material is a challenging task. In this article, a bio-material selection decision support system, namely BIOSEL has been developed to help decision makers in their selection of bio-materials. It has been written in Visual Basic 6.0 program and tested with a literature example. The developed selection program eliminates unsuitable materials in two steps. In the first elimination step, the decision maker obtains the proper bio-materials by entering limit values of the bio-compatibility and cost requirements. BIOSEL, then, uses different decision making methods to rank the materials. The application of BIOSEL shows that it is useful and easy to use.

Keywords: Decision support system, bio-material selection, decision making methods

EXTENDED MODELS FOR SUPPORTING CAPP-MES INTEGRATION IN DISCRETE PRODUCTION SYSTEMS (53)

Tibor TÓTH, *toth@ait.iit.uni-miskolc.hu* University of Miskolc, 3515 Miskolc, Hungary

Gyula KULCSÁR, *iitkgy@uni-miskolc.hu* University of Miskolc, 3515 Miskolc, Hungary

Ferenc ERDÉLYI, *ef@ait.iit.uni-miskolc.hu* University of Miskolc, 3515 Miskolc, Hungary

Mónika KULCSÁRNÉ FORRAI, *aitkfm@uni-miskolc.hu* University of Miskolc, 3515 Miskolc, Hungary

Péter BIKFALVI, *bikfalvi@uni-miskolc.hu* University of Miskolc, 3515 Miskolc, Hungary

ABSTRACT

Production Information Engineering faces big challenges in developing integrated computer support both for manufacturing control and for technology process planning. The two sets of software applications are located on different hierarchy levels of the enterprise functional model. In the field of discrete manufacturing, hierarchical structuring of engineering and management functions is the only utilizable “framework”. For integration purposes, only solving of term coherence problems is not enough, there is also a need for solving problems originating from the differences between the models used at the two levels. The paper shows the role of robust technological parameters concept as well as of the extended scheduling models in IT based integration and in realizing flexible and robust manufacturing control.

Keywords: Integration, Process Planning, Production Planning and Control, Detailed Scheduling, Manufacturing Execution System.

CONCEPTUALIZATION OF A WEB-BASED SOFTWARE PLATFORM THAT ENABLES CLEANER PRODUCTION AND INDUSTRIAL SYMBIOSIS (65)

Tuna Çağlar Gümüş, *tgumus@etu.edu.tr, TOBB University of Economics and Technology, 06560, Ankara, Turkey*

Christoph Hugi, *christoph.hugi@fhnw.ch, University of Applied Sciences and Arts Northwestern Switzerland*

Dirk Hengevoss, *dirk.hengevoss@fhnw.ch, University of Applied Sciences and Arts Northwestern Switzerland*

Sadık Engin Kılıç, *engin.kilic@atilim.edu.tr , Atılım University, 06830, Ankara, Turkey*

Guillaume Massard, *guillaume.massard@sofiesonline.com, SOFIES SA, Switzerland*

Murat Özbayoğlu, *mozbayoglu@etu.edu.tr, TOBB University of Economics and Technology, 06560, Ankara, Turkey*

Hakkı Özgür Ünver, *hounver@etu.edu.tr, TOBB University of Economics and Technology, 06560, Ankara, Turkey*

ABSTRACT

In this project the concept of a web-based service platform for Resource Efficient and Cleaner Production, as well as Industrial Symbiosis (CPIS) measures for individual or for groups of factories is presented. The platform allows to link companies with specialized consultants and provides functionalities to conduct CPIS projects. It includes data collection, analyzing and managing of material and energy flows, knowledge transfer, identification of CPIS improvement potentials and determining best optimal environmental and financial solutions for improving the overall resource efficiency.

Keywords: Cleaner Production, Industrial Symbiosis, Service Oriented Architecture

INVESTIGATION OF FREE-FORM SURFACE RECONSTRUCTION TECHNIQUES FOR REVERSE ENGINEERING OF WORN-OUT GAS TURBINE BLADES: A CASE STUDY (79)

Özgür POYRAZ, Ozgur.Poyraz@tei.com.tr, Tusaş Engine Industries, 26003, Eskişehir, Turkey

Oğuzhan YILMAZ, oyilmaz@gantep.edu.tr, University of Gaziantep, 27310, Gaziantep, Turkey

Evren YASA, evren.yasa@tei.com.tr, Tusaş Engine Industries, 26003, Eskişehir, Turkey

ABSTRACT

Harsh working conditions of gas turbine blades lead to various types of unexpected failures which result in a worn-out or broken blade. Besides replacement by a new blade, the repair of worn-out blades may be preferred as a low-cost solution. The adaptive repair of worn-out blades needs reverse engineering of the actual blade shape since the nominal CAD model may not be available or it may not fit to actual one because of distortions. Besides, each damaged blade is considered as a unique geometry. At this point the point cloud of damaged blade is needed to obtain actual blade geometry and damage analysis. The point cloud of an airfoil can be quickly obtained by using an optical measurement system; such as structured light or laser. Different surface generation techniques have been developed and implemented to commercial software platforms which offer auto surfacing from point cloud, or from splines which are extracted section curves of point cloud. In the repair of turbine

blades the worn-out or damaged surfaces must be reconstructed with minimum deviation in order to be effectively used in further repair stages, i.e. deposition and machining. This work presents a brief investigation of different free-form surface reconstruction techniques and an adaptive surface reconstruction method was developed for part-to-part variation. Virtual experiments were conducted on a high pressure compressor (HPC) blade data with commercial CAD software. The deviation of point cloud to generated surface in the original region and the deviation point cloud to extended surface in the worn-out area showed the method's accuracy for surface reconstruction.

Keywords: Adaptive blade repair, reverse engineering, optical measurement

EVALUATION OF A SCANNING TECHNIQUE USED FOR MEDICAL DESIGN APPLICATIONS (17)

Octavian CIOBANU, oct.ciobanu@gmail.com "Grigore T. Popa" University of Medicine and Pharmacy, Iasi, 700115, Romania

Gabriela CIOBANU, gciobanu03@yahoo.co.uk "Gheorghe Asachi" Technical University Iasi, 700050, Romania

ABSTRACT

The reverse engineering processes involve measuring an object and then reconstructing it as a 3D model. Any physical object can be measured using 3D scanning technologies like laser scanners, structured light digitizers, photogrammetry etc. The medical industry and medical bioengineers use detailed models of organs or of anatomic surfaces in order to design customized prostheses and orthoses. Also medical personnel need 3D models in order to perform different medical interventions. Paper approaches different typical objects and anatomic surfaces by photogrammetric scanning technique and 3D reconstruction using commercial software. Reconstructed objects are discussed and the quality of mesh models, shaded models and textured models are compared. The aim is to give users recommendations, which object or body part are suited for this type of scanning, or even if a combination of photogrammetry and another 3D scanning technique is advisable. Comments like possible applications, quality of the results are to be considered.

Keywords: 3D modeling, photogrammetry, 3D reconstruction, medical applications

BIOINSPIRED TRANSFORMATION FOR DESIGN OF BIOROBOTS (22)

Aylin KONEZ EROĞLU, *akonez@atilim.edu.tr* ATILIM University, 06838, Ankara, Turkey

Zuhal ERDEN, zuhal*@atilim.edu.tr* ATILIM University, 06838, Ankara, Turkey

Abdulkadir ERDEN, *aerden@atilim.edu.tr* ATILIM University, 06838, Ankara, Turkey

ABSTRACT

Bioinspired Design (BID) process, the use of nature to inspire, is based on analogical reasoning. Two key steps of this process are “biological system analysis” and “bioinspired transformation”. While biological systems are represented in the first step, the second step exhibits analogical translation. The main aim of this paper is to present the “bioinspired transformation” step of a developed bioinspired conceptual design (BICD) process of jointed-leg biorobots. During the studies, four biorobot case studies are implemented. Experimental results show that the transformation provides an easy and systematic mapping between biological and engineering domains. In this paper, one of the case studies, bioinspired dog robot (BioDog) is described for the bioinspired transformation step.

Keywords: Bioinspiration, Biomimetic, Bioinspired Design, Analogical Reasoning, Bioinspired Transformation, Biorobots

DEVELOPMENT OF AN AUTONOMOUS LAWN MOWER (72)

Serkan ÇİÇEK, *serkancicek@gmail.com,* Middle East Technical University, 06531, Ankara, Turkey

E. İlhan KONUKSEVEN, *konuk@metu.edu.tr,* Middle East Technical University, 06531, Ankara, Turkey

A. Buğra KOKU, *kbugra@metu.edu.tr,* Middle East Technical University, 06531, Ankara, Turkey

ABSTRACT

Starting from early 2000's domestic robots have been taking their place in our daily lives. Today, numerous products are globally available on the domestic robotics market. Among many domestic robot types, robotic cleaners and lawn mowers take the lead in this competition, with their success for reducing undesired house chores. It is becoming more and more crucial for developers to offer best navigation performance with the lowest price in the market. In this study, a differentially driven Autonomous Lawn Mower (ALM) with an enhanced position correction technique is developed. In this technique, odometric error compensation is applied, based on the identification of mowed and non-mowed lawn areas. After completion of the design, manufacturing and system integration tasks, performance tests have also been performed. These physical indoor and outdoor tests have been performed on different terrains with various coverage patterns.

Keywords: Autonomous Lawn Mower, Product Development, Industrial Design, Odometric Error Compensation, Coverage Performance

DESIGN OF A HUMANOID ROBOT SPINE CONSTRUCTED OF ASYMMETRIC PARALLEL MECHANISM MODULES (74)

Ekim YURTSEVER, *ekimyurtsever@gmail.com* Istanbul Technical University, 34437, Istanbul, Turkey

Şeniz ERTUĞRUL, *seniz@itu.edu.tr* Istanbul Technical University, 34437, Istanbul, Turkey

ABSTRACT

Conventional mechanical applications in humanoid robots cause non-human-like and discontinuous motion. In this work, to create human-like motions, a modular structure where every module can move relative to the preceding or the following module has been suggested. A novel parallel mechanism as a module has been designed for this purpose. Parallel mechanisms are attached to each other as modules to constitute the spine. In addition to the continuous movement, the mechanism is able to maintain its position when the motors cease to work, which makes the system mechanically stable. In simulations, the new concept design achieved to mimic human spine movements successfully. The modular spine like mechanism is designed as a part of a master thesis to be applied for an ongoing humanoid project in Istanbul Technical University, Faculty of Mechanical Engineering, System Dynamics and Control Laboratory.

Keywords: Humanoid trunk and spine design, Modular parallel mechanisms, asymmetric parallel mechanism

DEFECTS AND REMEDIES IN ADVANCED HIGH STRENGTH STEELS STAMPING (FO3)

Ilyas KACAR, *ikacar@gmail.com* Nigde University, Nigde, Turkey

Fahrettin OZTURK, *fozturk@pi.ac.ae* The Petroleum Institute, Abu Dhabi, UAE

Firas JARRAR, *fjarrar@pi.ac.ae* The Petroleum Institute, Abu Dhabi, UAE

ABSTRACT

In recent years, the use of advanced high strength steel (AHSS) in the automotive industry has been increased due to their role in increasing fuel economy and reducing carbon dioxide emissions. The lightweight AHSS structures would be the optimum choice for many applications; however, there are many defects to overcome in their stamping. In this present study, different types of defects and remedies of AHSS stampings are presented.

Keywords: Advanced high strength steel, Failure analysis, Damage behavior of multiphase steels, Failure prediction

RECENT TRENDS OF APPLICATION OF ADVANCED HIGH-STRENGTH STEELS IN AUTOMOTIVE INDUSTRY TO ENHANCE SUSTAINABILITY (FO4)

Suleyman KILIC, *suleymankilic@gmail.com* Ahi Evran University, 40200, Kirsehir, Turkey

Fahrettin OZTURK, *fozturk@pi.ac.ae* The Petroleum Institute, PO BOX 2533, Abu Dhabi, UAE

ABSTRACT

In recent years, vehicle weight reduction projects have brought significant improvements to fuel economy, with a concomitant reduction in carbon dioxide emissions. Lightening of a vehicle, without sacrificing the strength, performance, and comfort is the main target of the automotive industry; it is a major success when these parameters are improved. The lightening is usually accomplished by using thinner Advanced High Strength Steels (AHSS). In the present study, the use of AHSS in automotive industry is discussed. The advantages and disadvantages of these steels are evaluated.

Keywords: Advanced High Strength Steels, AHSS, DP, TRIP, CP, MS, TWIP

NOISE IN HYDRAULIC SYSTEMS AND PREVENTION METHODS (20)

H.Sevil ERGUR, *hsergur@ogu.edu.tr* Eskişehir Osmangazi University, 26480, Eskişehir

Yasar PANCAR, *ypancar@ogu.edu.tr* Eskişehir Osmangazi University, 26480–Eskişehir

ABSTRACT

This document presents the noise phenomena and prevention methods in hydraulic systems. Sound that is unwanted or disrupts one's quality of life is called as noise. It is also form of waste energy. When there is a lot of noise in the environment, it is termed as noise pollution. Noise is a broad and complex subject that is generally caused by pressure waves in the fluid stream. In hydraulic systems, there are three main forms of noise, such as air borne, fluid borne and structure borne. Fluid borne noise is one of the main components of hydraulic systems and its attenuation has a significant effect on the cost of systems. The noise level of a system is dependent on the complex interaction of a large number of components. The most common source of noise in hydraulic systems is the sound produced by the fluid itself. When the noise level created in the piping system exceeds the background noise level in any audible frequency band, it may become objectionable. When the created levels exceed 90 dB(A), permanent hearing damage can occur and a necessity of preventing erosion of the system components. Noise problems in liquid systems are comparatively low due to the flowrates in most piping systems are limited to reduce pressure drop. Noise emission by hydraulic system machinery has become a serious problem for fluid power equipment manufacturers and operators. Since the pumps are the largest component of sound power in hydraulic system, much more attention has to be given

on these elements. Noise levels generally depend on mounting method and present conditions of hydraulic circuit in which the pump is used. Due to for their high level of noise, hydraulic power systems may cause frequent complaints. Besides limiting the application of fluid power, these problems may also compel the designers to replace it with other methods of power transmission.

Keywords: Noise, sound power, fluid power, pressure waves, pressure drop, filter selection, hydraulic system.

CONTAMINATION PHENOMENA AND PREVENTION METHODS IN HYDRAULIC SYSTEMS (80)

H.Sevil ERGUR, *hsergur@ogu.edu.tr* Eskişehir Osmangazi University, 26480, Eskişehir

ABSTRACT

This paper presents the contamination phenomena and prevention methods related with fluid cleanliness in hydraulic systems. Fluid power is one of the most reliable and repetable forms of power and motion control. In hydraulic fluid systems, power is transmitted through a liquid under certain amount of pressure. Many factors can reduce the service life of hydraulic components. One of these factors is the contamination of hydraulic fluid by insoluble particles. In order to prevent the aging process, the hydraulic fluid cleanliness must be first defined and then maintained on a continuous basis. It is widely accepted that, particle contamination reduces the service life of hydraulic components. Fact is, some level of particle contamination is always present in hydraulic fluid, even in new fluid. The level of contamination or conversely, the level of cleanliness considered acceptable, depends on the type of hydraulic system. The presence of solid contaminants in the hydraulic fluid interferes with the ability of fluid to lubricate and causes wear to the system elements. That's why, it is necessary to control the solid contaminants which has direct performance of the system. Typical types of contamination that can threaten hydraulic systems include particulates, water, gases and bacteria. Combined with these contaminants, conditions of elevated temperatures and flow can lead to further chemical and physical degradation of hydraulic fluids. About 75% of all hydraulic systems degrade due to contaminated hydraulic fluids. Contamination will cause aging, degradation of fluids

and failure of hydraulic systems or a number of different reasons. While hydraulic system contaminants can be either solid particles or liquids, water is the most common. In general, solid particles contaminate by chemically reacting with the fluid. Contamination with liquids other than water can occur both miscible and immiscible fluids.

Keywords: Particle contamination, contamination standarts, filtration**,** cleanliness, fluid power, operation life, hydraulic system.

DESIGN AND VALIDATION OF A THREE-AXIS HIGH-PRECISION POSITIONING SYSTEM FROM MECHATRONICALLY MODULAR COMPONENTS (18)

Erva Ulu, *erva@bilkent.edu.tr, Bilkent* University, 06800, Ankara, Turkey

Nurcan Gecer-Ulu, *ulu@bilkent.edu.tr, Bilkent* University, 06800, Ankara, Turkey

Melih Çakmakcı, *melihc@bilkent.edu.tr, Bilkent* University, 06800, Ankara, Turkey

ABSTRACT

Precision positioning devices are used for almost every operation in micro/nano-scale applications. The positioning device introduced here is built from mechatronically modular single axis sliders and can also be reconfigured for a specific application without changing its mechanical or control software design. The sliders are modular due to their deliberate mechanical design, adaptive feature of encoder interpolation technique and structure of learning based cross-coupled control algorithm. Moreover, the sensitivity of the system is also reconfigurable by changing the encoder resolution for a specific application so that optimum velocity vs resolution trade offs can be fully utilized. Performance of the overall three axis positioning system with its mechanical design, encoder signal interpolation and position control algorithm is shown through validation and experiments. The integrated precision positioning system achieves nanometer level tracking and contouring performance utilizing a modular but axis coupled control algorithm.

Keywords: Modularity, nano-positioning

VIBRATION AND BIFURCATION ANALYSIS OF ULTRA SHORT AEROLUBRICATED JOURNAL BEARING SYSTEM (30)

C. C. WANG, *wccpipn@yahoo.com.tw* National Chin-Yi University of Technology, 41170, Taichung, Taiwan

H. T. YAU, *htyau@cc.ncut.edu.tw* National Chin-Yi University of Technology, 41170, Taichung, Taiwan

ABSTRACT

This paper analyzed the vibration behaviors and bifurcation phenomenon of a rigid rotor with different mass supported by ultra short aero-lubricated journal bearing (USAJB) system. The differential transformation method and finite difference method are combined and used to investigate gas pressure distribution of USAJB system. The results are shown that system exists five intervals behaving chaotic motions over the range $1.0 \leq mr \leq 9.0$kg, and the maximum Lyapunov exponent is positive as chaos occurred.

Keywords: Ultra short aero-lubricated journal bearing, differential transformation method, chaos.

MECHANICAL STRUCTURE DESIGNS FOR TWO AXIS SOLAR TRACKERS (36)

H. Orhan YILDIRAN, oyildiran*@atilim.edu.tr* ATILIM University, 06830, Ankara, Turkey

ABSTRACT

Solar energy usage/production was one of the research area given to team of students of ATILIM University in different years. In these projects students are requested to harvest energy by tracking the sun in two axis. Three of such projects have already been performed by the students.

Since requested specifications of the tracking system were different in each year, three different mechanical structures were studied, and will be given in this paper. Also problems encountered in these systems will be discussed.

A new Project has been started and the students are in research phase. The two axis, directing a parabolic collector to the sun will be actuated by linear actuators in this system. Result of pre studies for this Project will also be given in this paper as 3D CAD model which was designed with the intent of guiding and giving insight as one of the many alternatives, to the students.

Keywords: Solar Energy, Solar Tracking Systems, Parabolic Collectors, Linear Actuators, Mechanical structures

THE TOOL-CHIP CONTACT LENGTH USING A NEW SLIP LINE SOLUTION FOR ORTHOGONAL CUTTING (39)

Shao-Hsien Chen, *e6036@ncut.edu.tw,* Department of Mechanical Engineering, National Chin-Yi University of Technology

ABSTRACT

Tool-chip contact length is an important parameter in machining, the paper develops a new analytical model to simulation the normal stress in machining with Inconel-718 and Mar-M247, the force balance is conducted on the upper boundary of the deformation zone leading to the machining force model, this machining force component are an explicit function of the edge radius and shear angle, the model increase in edge radius leads to not only increased ploughing forces but also an increase in the chip formation force due to an average rake angle effect. Intercept at zero uncut chip thickness, Calculation of shear stress on the lower boundary of the deformation zone using the new machining force model referral that the apparent size effect when cutting with edge radiused tools is due to deformation below the tool and the larger chip formationcomponent due to a lower shear angle. the model colud be useful in solution of various problem of machining.

MODELLING OF CUTTING FORCES IN FACE MILLING Ti6Al4V SUPERALLOY WITH a-CN/TiAlN COATED CARBIDE TOOLS (56)

Halil ÇALIŞKAN, *hcaliskan@bartin.edu.tr* Bartın University, 74100, Bartın, Turkey

ABSTRACT

Ti6Al4V, widely used in aerospace and medical industry, is known as one of difficult-to-machine materials. To increase machinability of this material is a challenge for researchers. In this study, the cutting force components (F_x, F_y, F_z) during face milling of Ti6Al4V with a-CN/TiAlN coated carbide tools was modeled by response surface methodology in order to reveal the influence of cutting parameters on the machinability of Ti6Al4V. It was found that predicted cutting forces are in good agreement with the experimental ones. The lowest cutting force can be obtained at the lowest feed rate and intermediate cutting speed used.

Keywords: a-CN/TiAlN coating, Ti6Al4V, Face milling, Cutting force, Machinability

THE EFFECTS OF CUTTING PARAMETERS ON CHIP-TOOL INTERFACE TEMPERATURE AND SURFACE ROUGHNESS IN TURNING OF WASPALOY (84)

M. Cemal CAKIR, *cemal@uludag.edu.tr,* Uludag University, 16059 Gorukle, Bursa, TURKEY

Abdil KUS, *abdilkus@uludag.edu.tr,* Uludag University 16059 Gorukle, Bursa, TURKEY

Yahya ISIK, *yahya@uludag.edu.tr,* Uludag University 16059 Bursa, TURKEY

ABSTRACT

Waspaloy is difficult-to-machine material used for gas turbine engine components that call for considerable strength and corrosion resistance at high operating temperatures. The machining of nickel-based alloys generates high temperatures at the cutting tool edge. In this research, the correlation between cutting parameters and cutting temperature that were recorded using infrared thermometer was investigated. Besides, the effects of cutting parameters on surface roughness were also observed. Experiments were conducted on Waspaloy AMS5708 round (ϕ38x300) bar samples using PVD TiAlN-TiN coated WNVG 080404-IC907 carbide insert as the cutting tool. As the result of experiments he highest cutting speed and the lowest feed rate produced higher temperature. This situation was similar for the surface roughness. It was observed that better surface roughness was obtained by the lowest feed rate, the highest cutting speed and the higher cutting depth. No cutting fluid was used in the experiments.

Keywords*:* Infrared thermometer, cutting parameters, Waspaloy, cutting temperature, turning

A CPG BASED GAIT GENERATION FOR 12 DOF BIPED ROBOT (BIROL) USING ZMP CRITERIA (44)

M.Hassan Gol.M.Z, *gol_mz@yahoo.com* Mechatronics Engineering Department, Atılım University, Ankara, Turkey

Kutluk B. ARIKAN, *kbarikan@atilim.edu.tr* Mechatronics Engineering Department, Atılım University, Ankara, Turkey

Bülent İrfanoğlu, *birfanoglu@atilim.edu.tr* Mechatronics Engineering Department, Atılım University, Ankara, Turkey

ABSTRACT

This article reports on the developments of the bipedal walking robot BIROL which has 12 degrees of freedom (DOF) and is actuated by servomotors that are controlled in real time by RTWT through Matlab/Simulink. Before designing the controller, mathematical model has been obtained using Denavit-Hartenberg convention and Newton-Euler method.

A dynamically consistent motion pattern is generated off-line by using central pattern generators (CPG) for the 12 DOF BIROL Robot. In order to keep the balance of the robot, the motion pattern consists of the desired trajectories of all joints and the desired zero moment point (ZMP) trajectories.

Keywords: Biped robots, control architecture, motion control, gait generation, walking stability, central pattern generators (CPG), zero moment point (ZMP)

INNOVATIVE VIRTUAL MACHINE TOOL DESIGN (47)

Tzuo-Liang LUO, *tzuolianglo@itri.org.tw*, Intelligent Machine Tool Technology Center, Industrial Technology Research Institute, 40768, Taichung, Taiwan (R.O.C.)

Chien-Chih LIAO, *kenziliao@itri.org.tw*, Intelligent Machine Tool Technology Center, Industrial Technology Research Institute, 40768, Taichung, Taiwan (R.O.C.)

Z. Murat KILIÇ, *kilic@alumni.ubc.ca,* Manufacturing Automation Laboratory, University of British Columbia, V6T1Z4, Vancouver, Canada

Yusuf ALTINTAŞ, *altintas@mech.ubc.ca,* Manufacturing Automation Laboratory, University of British Columbia, V6T1Z4, Vancouver, Canada

ABSTRACT

Modern design methodology uses the state-of-art computational technology to perform detailed machine tool design and simulation. Considering the long computation efforts during design process, it is important to ensure the quality in a given limited time of the design project through science-based automated design. Intelligent Machine Tool Technology Center (ITTC) of Industrial Technology and Research Institute (ITRI, Taiwan) and Manufacturing Automation Laboratory (MAL) of University of British Columbia (UBC, Canada) are currently developing the concept of Virtual Machine Tool Design. This concept combines Virtual Metal Cutting Simulation, Topology Optimization, and Mechatronics Simulation of machine-tool in a virtual engineering environment. The main goal is to automatically design the machine-tool to satisfy the rigidity based on the requirement of the machining application. The methodology significantly speeds up the design process while assuring the quality.

Keywords: Automatic design, virtual machine tool.

DESIGN AND ANALYSIS OF A PARALLEL MECHANISM FOR KINEMATICALLY REDUNDANT HYBRID PLANAR LASER CUTTING MACHINE (50)

M. İ. Can DEDE, *candede@iyte.edu.tr* İzmir Institute of Technology, 35430, İzmir, Turkey

Erkin GEZGİN, *erkin.gezgin@ikcu.edu.tr* İzmir Katip Çelebi University, 35620, İzmir, Turkey

Gökhan KİPER, *gokhankiper@iyte.edu.tr* İzmir Institute of Technology, 35430, İzmir, Turkey

Ercan MASTAR, *emastar@coskunoz.com.tr* Coşkunöz Metal Form, 16159, Bursa, Turkey

Tayfun SIĞIRTMAÇ, *tsigirtmac@coskunoz.com.tr* Coşkunöz Metal Form, 16159, Bursa, Turkey

Emre UZUNOĞLU, *emreuzunoglu@iyte.edu.tr* İzmir Institute of Technology, 35430, İzmir, Turkey

ABSTRACT

Conventional planar laser cutting machines cannot achieve high accelerations, because the required precision values cannot be achieved due to the high inertial loads. Machines configured as kinematically redundant mechanisms are able to reach 5-6 g acceleration levels since they include a parallel mechanism with a smaller workspace which is exposed to smaller inertial loads. The study presented in this paper focuses on the design of a parallel planar mechanism to be integrated to the main axes of conventional planar laser cutting machines to achieve higher accelerations of the laser head up to 6 g. Parallel mechanism's conceptual design and

dynamic balancing studies are provided along with the joint clearance effect on precision due to having more joint structures.

Keywords: Kinematically redundant machine, Planar laser cutting machine, dynamic balancing, Joint clearance

MODELLING CONE ANGLE DEFORMATION OF MICROTUBES IN FLARING PROCESS (35)

Tsung-Chia Chen, *ctchen@ncut.edu.tw* National Chin-Yi University of Technology, Taichung, Taiwan

Wei-Kai Ceng, *s4a111006@student.ncut.edu.tw* National Chin-Yi University of Technology, Taichung, Taiwan

ABSTRACT

This study, with experiments and comparisons, aims to analyze the difference of stainless (SUS316L) microtubes in the flaring forming among dies with various semi-cone angles (35˚, 40˚, 45˚, 50˚, 55˚). The flow rule in Prandtl-Reus combined with finite element deformation theory and Updated Lagrangian Formulation (ULF) is applied to establishing the finite element analysis equation for an incremental elasto-plastic deformation to simulate the microtube flaring process. The broad rmin algorithm is utilized in the forming process for elasto-plastic state and die contact. The simulation data allow acquiring the deformation traceability, the relationship between punch load and punch stroke, the distribution of stress and strain, the distribution of the thinnest thickness resulted from dies with different semi-cone angles, and the distribution of flaring radius caused by dies with distinct semi-cone angles in the forming process. The experimental result presents the similar results between the relationship between punch load and punch stroke and the simulation of coefficient of friction μ=0.05, revealing the analysis being suitable for the analysis of microtube cone angle flaring process. The analysis and experimental results show the thinnest thickness of the microtube increases with increasing semi-cone angles of dies, and

the maximal flaring radius of microtubes increases with increasing semi-cone angles of dies.

Keywords: Stainless steel, Tube end flaring, Finite element, Elasto-plastic

FABRICATION OF MICROFLUIDIC DEVICES FOR DIELECTROPHORETIC AND ACOUSTOPHORETIC APPLICATIONS USING HIGH-PRECISION MACHINING (43)

Soheila Zeinali, soheila.zeinali@bilkent.edu.tr İhsan Doğramacı Bilkent Univesity, 06800, Ankara, Turkey

Barbaros Çetin, barbaros.cetin@bilkent.edu.tr İhsan Doğramacı Bilkent Univesity, 06800, Ankara, Turkey

M. Bülent Özer, mozer@etu.edu.tr TOBB University of Economics and Technology, 06560, Ankara, Turkey

Süleyman Büyükkoçak, sbuyukkocak@.etu.edu.tr TOBB University of Economics and Technology, 06560, Ankara, Turkey

ABSTRACT

In this study, the fabrication of microfluidic devices for dielectrophoretic and acoustophoretic based applications with high-precision CNC machining has been presented. For both devices, molds out of stainless steel have been fabricated, and polymer molding is implemented. For dielectrophoretic device, the metal electrodes have been fabricated using high-precision machining and embedded into the device during the molding process. For acoustophoretic device, piezoelectric slides have been embedded into the device during the molding process. This is a pioneer study for the fabrication of microfluidic devices with embedded 3D electrodes and PZT slides.

Keywords: Microfluidics, Dielectrophoresis, Acoustophoresis, High-precision machining

MICROMACHINING WITH NS-PULSED FIBRE LASERS: MATERIALS, APPLICATIONS AND SECTORS (70)

Ali Gökhan DEMİR, *aligokhan.demir@polimi.it* Politecnico di Milano, 20156, Milan, Italy

Barbara PREVITALI, *barbara.previtali@polimi.it* Politecnico di Milano, 20156, Milan, Italy

ABSTRACT

In today's industrial micromachining applications lasers play a fundamental role. As a highly flexible, versatile and non-contact tool lasers enable high precision machining on polymers, metals, semi-conductors and ceramics. The introduction of commercial fibre lasers in the market during the last decade resulted in a larger diffusion of lasers in the industry due to their stability and ease of operation. Micromachining operations also benefited from the use of solid state highly efficient lasers. This work gives an outlook on some of the key materials, sectors and applications concerning pulsed fibre laser micromachining.

Keywords: Fibre laser, Microdrilling, Microcutting, Surface texturing, Colour marking

EXPERIMENTAL INVESTIGATION OF THE PROCESS PARAMETERS ON THE FORMING FORCE FOR SINGLE POINT INCREMENTAL FORMING (83)

Barış ÖZGEN, *baozgen@ku.edu.tr* Koç University, 34450, İstanbul, Turkey

İsmail LAZOĞLU, *ilazoglu@ku.edu.tr* Koç University, 34450, İstanbul, Turkey

İsmail DURGUN, *Ismail.Durgun@tofas.com.tr*, Tofaş Inc., 16369, Bursa, Turkey

ABSTRACT

Incremental sheet metal forming (ISF) is considered as one of the most promising prototyping technologies, providing an inexpensive method to produce sheet metal parts. The dieless process offers flexibility to the manufacturer, since small batches of different sheet metal parts can be formed with a CNC machine easily. This paper investigates the effects of process parameters on the forces generated during the formation process. The related process parameters are: the feed rate, the vertical step size between contours, the tool diameter and the wall angle. The results are obtained with a series of experiments conducted on 3 – axis CNC milling machine. The experimental results revealed that it is possible to use CNC milling machines in producing sheet metal parts. However, the selection of process parameters has a great effect on the forces generated during the deformation process. The force data is beneficial for the machine tool design process.

Keywords: Incremental Sheet Metal Forming, Rapid Prototyping, Forming Forces, CNC Milling Machine

CONTACT LINE ANALYSIS OF WORM GEARINGS HAVING ARCHED PROFILE (51)

László DUDÁS, *iitdl@uni-miskolc.hu* University of Miskolc, 3515, Miskolc, Hungary

ABSTRACT

The good contacting characteristics of worm drives having circular arc in the axial section of the worm are well-known. The paper investigates other arched profiles to determine better meshing properties. The investigated profile curves are circle arc, ellipse arc, parabolic arc and fourth order parabolic arc. The surface modelling is performed by the Surface Constructor software application. The conclusion is that the angle between the contact lines and the relative sliding velocity vector is only one important factor and the global cut produced by the hob has also to be considered among the qualifying meshing properties.

Keywords: Worm gear, Worm profile, Meshing properties, Undercut, 3D modelling

DEVELOPMENT OF A TEST SYSTEM FOR VISCOELASTIC MATERIAL CHARACTERIZATION (82)

Fulya EROL, *efulya@metu.edu.tr* Middle East Technical University, 06800, Ankara, Turkey

Gökhan O. ÖZGEN, *gozgen@metu.edu.tr* Middle East Technical University, 06800, Ankara, Turkey

Halil ARDIÇ, *hardic@roketsan.com.tr* Roketsan A.Ş., 06780, Ankara, Turkey

Bilgehan ERDOĞAN, *bilgehan@hgmekanik.com.tr* HG Mekanik Ltd. Şti., 06800, Ankara, Turkey

S. Samet ÖZKAN, *sozkan@roketsan.com.tr* Roketsan A.Ş., 06780, Ankara, Turkey

ABSTRACT

This paper explains the studies carried out for developing a test system for viscoelastic material (VEM) characterization. The purpose is to determine the frequency and temperature dependent dynamic properties of VEMs so that an effective vibration control or isolation mechanism can be designed utilizing VEMs. The test method is selected as driving-point method and the mechanical design studies are carried out accordingly. During the mechanical design, first of all, alternative concepts are generated for the test set-up configuration, and then the embodiment design of the test set-up is conducted utilizing finite element modeling technique to achieve the best performing configuration. In addition, the sensors, vibration exciter, data acquisition hardware and temperature control unit are selected. Furthermore, a dedicated test software that is able to generate the excitation as well as collect, process, save and monitor the measured test data is developed in LabVIEW. Finally, the designed test

set-up is manufactured and installed with the selected electrical and electronic test equipment, and sample characterization tests are conducted with prepared viscoelastic specimens.

Keywords: viscoelastic material characterization, elastomer dynamic testing, dynamic stiffness measurement, elastomer test systems/equipment/machine

ROBUST FUZZY-PID CONTROL OF AN UNBALANCED QUADROTOR (85)

Ahmed AKSAL, *ahmed.aksal@roketsan.com.tr* Atilim University, 06830, Ankara, Turkey

Kutluk Bilge ARIKAN, *kbarikan@atilim.edu.tr* Atilim University, 06830, Ankara, Turkey

Fuad ALİEW, *faliew@atilim.edu.tr* Atilim University, 06830, Ankara, Turkey

ABSTRACT

In this paper, we presented a robust fuzzy-PID control designed for attitude stabilization of an unbalanced quadrotor platform that will be used for load carrying. Constructed non-linear model and controller is simulated in Matlab/Simulink environment. The control algorithm is tested on shifted center of gravity with various disturbances acting on the system and the results are discussed.

Keywords: Fuzzy-PID controller, Unbalanced quadrotor, Attitude stabilization. Disturbance observer

INVESTIGATION OF THE EFFECT OF TITANIUM (TI) ADDITION TO THE MG-AZ31 ALLOY IN THE CAST CONDITION AND AFTER EXTRUSION AND ITS EFFECT ON METALLURGICAL AND MECHANICAL CHARACTERISTICS (2)

ADNAN I .O. ZAID, *a_kilani43@hotmail.com*, Industrial Engineering Department, University of Jordan, Amman 11942 Jordan.

RAGHAD, S. HEMEIMAT, *raghad_hemeimat@hotmail.com***,** Industrial Engineering Department, University of Jordan, Amman 11942 Jordan

ABSTRACT

Magnesium- aluminum alloys are versatile materials, which are used in manufacturing a number of engineering and industrial parts in the automobile and aircraft industries it is alloyed with other elements mainly aluminum and zinc to improve the required properties particularly to achieve high strength - to- weight ratio. Against these preferable characteristics, magnesium is difficult to deform at room temperature. Grain refinement is an important technology to improve the mechanical properties and the microstructure uniformity of the alloys. Most of the published work on grain refinement was directed toward grain refining auminum and zinc alloys; however, the effect of the addition of rare earth material on the grain size or the mechanical behavior of Mg alloys is rare. In this paper the effects of Ti addition on the grain size, , ductility, extrusion force and energy, of Mg-AZ31 alloy are investigated in two conditions, first in the as cast condition and the second after extrusion. It was found that addition of Ti to Mg- AZ31 alloy resulted in reduction of its grain size by 14%; the reduction in grain size after extrusion was much higher. Furthermore, an increase in the strength coefficient by 36% was achieved with the addition of Ti to Mg-AZ31 alloy in the cast

condition. Similarly, the work hardening index was also increased indicating an enhancement of the ductility and formability. Regarding the extrusion process, it was found that the force and energy required for the extrusion process were reduced by 57% and 59% respectively.

Keywords: Titanium, MgAZ31, Cast condition Extrusion, Mechanical behavior, Ductility

EFFECT OF MOLYBDENUM ADDTION TO ZINC-ALUMINUM 22, ZA22, ALLOY ON GRAIN SIZE AND MECHANICAL PROPERTIES AFTER PRESSING BY THE EQUAL CHANNEL ANGULAR PRESSING, ECAP (3)

Adnan I. O. Zaid, *a_kilani43@hotmail.com*, Industrial Engineering Department, University of Jordan, Amman, Jordan.

Jehad A. S. AlKasasbeh, *jehaddou@yahoo.com*, Industrial Engineering Department, University of Jordan, Amman 11942 Jordan.

Safwan M. A. Alqawabah, *safwan_q@yahoo.com*, Mechanical Engineering Department, Tafila Technical University, Amman 11942 Jordan

ABSTRACT

In this paper, the effect of molybdenum addition as a grain refiner to zinc-aluminum 22%, ZA22, alloy was investigated in two conditions: first in the as cast conditions and the second after pressing by the equal channel angular pressing, ECAP. Recently the ECAP process has been used to produce severe plastic deformation. It was found that addition of Mo to ZA22 alloy at any rate (within the experimental range 0.5% to 0.15%) resulted in grain refinement of its structure both in the cast and after pressing conditions. Furthermore, it resulted in enhancement of its mechanical strength at small values of strain < 30% but resulted in decrease of its mechanical strength beyond this value, indicating softening of the alloy. Regarding the effect on its hardness, it decreased at any rate of Mo addition, being more pronounced after pressing by ECAP. The maximum decrease was 49% which occurred at 0,1% Mo addition.

Keywords: Zinc-Aluminum alloy, ZA22, molybdenum, Equal Channel Angular Pressing, Microstructure, Mechanical Behavior.

EFFECT OF Zr ADDITION ON THE MECHANICAL CHARACTERISTICS AND WEAR RESISTANCE OF Al GRAIN REFINED BY Ti AFTER EXTRUSION (5)

Adnan I. O. Zaid, *a_kilani43@hotmail.com*, Industrial Engineering Department, University of Jordan, Amman, Jordan.

Safwan M. A. Alqawabah, *safwan_q@yahoo.com*, Mechanical Engineering Department, Tafila Technical University, Amman, Jordan

ABSTRACT

Aluminum and its alloys are normally grain refined by Ti or Ti+B to transfer their columnar structure during solidification into equiaxed one which improves their mechanical behavior and surface quality. In this paper, the effect of addition of Zr on the mechanical characteristics, hardness, ductility and wear resistance of commercially pure aluminum is investigated. Titanium was added at a level of 0.15 % wt. This ratio corresponds to the peritictic limit on the Al-Ti phase diagram and is normally used for the grain refinement of aluminum. Zr was added at a level of 0.1% which also corresponds to the peretictic limit at the Al-Zr phase diagram. The experimental work was carried out after direct extrusion. It was found that addition of Ti resulted in 71.8% decrease in Al grain size, whereas addition of Zr alone at the above mentioned level resulted in 41% reduction of grain size, and 5i 3% when added in the presence of Ti. This led to increase Al hardness by 75.8%, 21.6% and 43.24% respectively. The effect of the addition of Ti or Zr alone on the mechanical characteristics of Al resulted almost in the same improvement, where 34.3% increase in its flow stress at 20% strain was achieved, whereas only 7.3% was achieved when both added together. As for the strain hardening index ,n, 154.5% increase was

obtained when Ti or Zr was added alone and 63.6% increase when added together i.e. resulting in pronounced improvement of its formability. Similarly, Improvement in its ductility represented by the maximum elongation and the maximum reduction percentages, from the tensile test by adding them either alone or together was achieved. Regarding the effect of Zr on the wear resistance of aluminum it was found that at small loads and speeds addition of Ti or Zr or both together resulted in deterioration of its wear resistance whereas at higher loads and speeds resulted in pronounced improvement of its wear resistance. Finally, the available Archard model and the other available models which considers only the mass loss failed to describe the wear mechanism of Al and its microalloys investigated in this paper due to the mushrooming effect at the worn end.

Keywords: Aluminum, Grain Refinement, Titanium, Zirconium, Mechanical Characteristics, Wear resistance, Direct Extrusion.

THE USE OF SUPERPLASTIC TIN-LEAD ALLOY AS A SOLID LUBRICANT IN METAL FORMING PROCESSES IN GENERAL AND IN FORGING IN PARTICULAR (13)

Adnan I.O.Zaid, *a.kilani@ju.edu.jo*, Industrial Engineering department, university of Jordan, Amman Jordan

Hebah B. Melhem, *Hiba.b.melhem@hotmail.com*, Industrial Engineering department, university of Jordan, Amman-Jordan

ABSTRACT

The main function of a lubricant in any forming process is to reduce friction between the work piece and the die set, hence reducing the force and energy requirement for forming process and to achieve homogenous deformation. The free upsetting test is an important open forging test. In this paper, superplastic tin-lead alloy is used as solid lubricant in the free upsetting test of ferrous and non-ferrous materials and compared with eight different lubricants using the following three criteria: one comparing the value of the reduction in height percentages, i.e. the engineering strain, in identical specimens of the same material under the effect of the same compressive force. The second is comparing the amount of barreling produced in each of the identical specimens, at each lubricant. The third criterion is using the specific energy, i.e. the energy per unit volume consumed in forming each material, using the different lubricants to produce the same reduction in height percentage of identical specimens from each of the two materials, namely: die steel, D_2, and stainless steel. It was found that the superplastic tin-lead alloy lubricant has produced higher values of reductions in height percentage and less barreling in the two ferrous materials, used in this work, among the different used lubricants.

Keywords: Solid lubricants, Superplastic tin-lead alloy, Free upsetting, Different lubricants.

COPPER POWDER REINFORCED POLYESTER ELECTRODES IN ELECTRIC DISCHARGE MACHINING (12)

Kemal YAMAN, *kemal.yaman@tubitak.sage.gov.tr* TUBİTAK-SAGE, Ankara, Turkey

Can ÇOĞUN, *cogun@cankaya.edu.tr* Çankaya University, 06810, Ankara, Turkey

ABSTRACT

The aim of this study was to develop an alternative electrode production method to manufacture electrodes in an easier and cheaper way in electric discharge machining (EDM). In this study, polyester resin was chosen as the matrix and the dendrite shape copper powder was used as filler. The electrical resistances of the produced composite electrodes were measured for their suitability as EDM electrode. The effect of composite electrodes filler concentrations on material removal rate, tool wear rate and relative wear characteristics were investigated. The prototyped composite electrodes by the introduced method were found successful in machining workpieces in EDM.

Keywords: EDM, composite electrode, copper powder, percolation concentration, rapid prototyping, material removal rate, tool wear rate.

DEVELOPMENT AND ANALYSIS OF DOUBLE-FACED WITH RADIAL AND CLUSTER-ARRANGED CMP DIAMOND DISK (16)

M. Y. Tsai, *mytsai@ncut.edu.tw* ,Department of Mechanical Engineering, National Chin-Yi University of Technology, No.57, Sec. 2, Zhongshan Rd., Taiping Dist., Taichung 41170, Taiwan

C. H. Chen, ,Chung-Shan Institute of Science and Technology, No.481, Sec. Chia an, Zhongzheng Rd, Longtan Shiang, Taoyuan County 325,Taiwan

J. H. Chiang, ,Chung-Shan Institute of Science and Technology, No.481, Sec. Chia an, Zhongzheng Rd, Longtan Shiang, Taoyuan County 325,Taiwan

ABSTRACT

In semiconductor manufacturing, diamond disks are indispensable for dressing chemical mechanical polishing (CMP) pads. Recently, 450-mm (18-inch)-diameter wafers have been used to improve output and reduce wafer production cost. To polish 450-mm-diameter wafers, the diameter of polishing pads must be increased to 1050mm. In particular, because diamond disks are limited to 100-mm diameters, a much greater number of working crystals will be required for dressing a 1050-mm-diameter pad. Consequently, new diamond disks must be developed. In this study, novel arrangements are made using a braze in diamond patterns, which are radial with a cluster-arrangement of 3–4 grits per cluster. Furthermore, a double-faced combined diamond disk is developed. The polishing pad surface was characterized, and the effect of different diamond conditioners on wafer removal rate was studied. This research aims to develop a more suitable diamond disk for dressing 1050-mm-diameter polishing pads.

EFFECTS OF CUTTING PARAMETERS ON THE MATERIAL REMOVAL RATE AND SURFACE QUALITY OF AL 7075 IN TURNING OPERATION WITH ABRASIVE WATERJET MACHINE (55)

Muhammad A.HASAN, *melan.sar.md1989@gmail.com*, Gaziantep University, Gaziantep, Turkey

Mustafa DERE, *dere@antep.edu.tr*, Gaziantep University, Gaziantep, Turkey

İ. Hüseyin FİLİZ, *hfiliz@gantep.edu.tr* Gaziantep University, Gaziantep, Turkey

ABSTRACT

In this study, an experimental turning set up is coupled with AWJ machine and the effects of turning parameters on material removal rate (MRR) and surface roughness have been investigated through a series of experiments. Aliminum alloy (Al 7075-T6) which is frequently used in automotive and aerospace industries is used as the workpiece material. Three different diameters of aluminum alloy (Al 7075-T6) are presented. Water jet pressure (p), feed rate (f), waterjet impact distance (e) are the three cutting parameters. Diameter of the workpiece (d) is considered as another factor in this study. A total of 81 AWJ turning experiments are conducted basing on three-level full factorial design of experiment for the four factors. From the results of these experiments it is noticed that waterjet impact distance and the feed rate are the most effective parameters on the material removal rate and surface quality. Material removal rate and surface roughness increase with an increase in both of feed rate and impact distance. On the other hand, an increase in water jet pressure results in an increase in surface quality and a little increase in MRR. Diameter has also effect of increasing MRR and surface roughness to a certain extent

Keywords: Aluminum alloy, abrasive water jet turning, material removal rate, surface roughness.

FINITE ELEMENT ANALYSIS OF FINGER JOINT IMPLANT

T. Aziz, *tariq_aziz_37@yahoo.com,* Advanced Manufacturing Institute, King Saud University, 11421, Riyadh, KSA.

S. Saied Darwish, *darwish@ksu.edu.sa*, Advanced Manufacturing Institute, King Saud University, 11421, Riyadh, KSA.

A. M. Al-Ahmari, *alahmari@ksu.edu.sa,* Advanced Manufacturing Institute, King Saud University, 11421, Riyadh, KSA.

Hazem al khawashki, *bonedoc57@gmail.com, college of medicine,* King Saud University, Riyadh, KSA.

ABSTRACT

In arthroplasty, a hinged prosthesis is inserted between the metacarpal and the first phalanx of the finger. Implants made were introduced to allow maximum joint flexibility and reduce joint pain effectively. Computer Tomography data of the fingers is imported into MIMICS software and then segmentation is performed. The 3-D model for the finger joints is developed using CATIA software. Fixation of the implant to the gap location was performed using MIMICS. The analysis of normal finger with respect to the implanted is done through ANSYS software. The materials were assumed to be homogeneous, isotropic and linear elastic. Additive manufacturing technology is used to finally manufacture the implant.

Keywords: MIMICS, CATIA, ANSYS software, Finite element Analysis, Fingers joint, Additive manufacturing.

CHARACTERIZATION OF C67S SHEET METAL AND DESIGN OF MANUFACTURING STEPS WITH FINITE ELEMENT ANALYSIS (46)

H. Onat TUĞRUL, *onat.tugrul@ors.com.tr,* ORS Bearings Inc., Polatli, Ankara, Turkey

D. Kıvanç AKSUNGUR, *daksungur@atilim.edu.tr*, Atilim University Metal Forming Center of Excellence, Incek, Ankara, Turkey

Celalettin KARADOĞAN, *ckaradogan@atilim.edu.tr*, Atilim University Metal Forming Center of Excellence, Incek, Ankara, Turkey

ABSTRACT

Sheet metal bearings which are used in clutch systems of modern manual transmission cars, have benefits of green production, light weight and space saving for more compact clutch systems. For a usual massive bearing ring 100Cr6 steel is used so that the bearing ring will have high machinability in a short spherodizing time and high hardenability in order to increase its fatigue resistance. For the case of sheet metal bearing rings, high carbon steel sheets and especially spring steels are used. Spring steels have higher yield strength than low carbon plain carbon deep drawing steels which makes it difficult to design the die system producing a crack free product.. In this study, the finite element method is used to develop a five stage die system using a virtual trial-error procedure. The realistic behavior in the simulation environment is achieved through careful mechanical characterization. Simufact Forming FEA program is utilized. Results of simulations for a former design and the developed one is comparatively demonstrated and superiorities of the improvement are explained.

Keywords: Mechanical Characterization, Sheet Metal Forming, Finite Element Analysis, Sheet Metal Bearings

IMPLEMENTATION OF RATE-AND-STATE FRICTION LAW IN FINITE ELEMENT SIMULATION OF SLIDING MOTION USING USER-DEFINED SUBROUTINE (81)

Babak RAJIHAMED, *babak.rajihamed@metu.edu.tr* Middle East Technical University, Department of Aerospace Engineering, 06830, Ankara, Turkey

Demirkan ÇÖKER, *coker@metu.edu.tr* Middle East Technical University, Department of Aerospace Engineering, 06800, Ankara, Turkey

ABSTRACT

In recent decades the science of tribology witnessed the development of different theoretical friction laws. In the past, the sliding behavior between solids was simulated based on classical contact mechanics and Coulomb friction law. However, recently, Rate and State dependent friction laws have been known to be more accurate friction models and defines new formulation of sliding resistance. The aim of this paper is to determine the influence of rate and state variables on friction coefficient by using commercial finite element code, ABAQUS. Available defined friction formulations in ABAQUS are based on Coulomb friction law so that a user-defined friction subroutine is written to model sliding of two plates based on Rice-Ruina friction law. Results explain behavior of velocity and friction coefficient with respect to time.

Keywords: Rate-and-State friction law, ABAQUS/Explicit subroutine

CHARACTERISTICS OF ALUMINUM FOAM UNDER DIFFERENT LOADING RATES (61)

A. A .Hussein, W. M. Chairladies, A. A. Khalil, A. A. Nasser

Department of Mechanical Engineering, Faculty of Engineering , Assiut University, Assiut , Egypt –E-mail: abobakr@aun.edu.eg

ABSTRACT

In this paper aluminum foam was produced using pure aluminum powder and calcium carbonate as foaming agent. This procedure ensures a low cost production method. Samples of aluminum foam were tested under both static and dynamic loading conditions. The quasi-static compression tests were used to evaluate the static characterization of aluminum foam. Hopkinson pressure bar arrangement was used to study dynamic properties of the produced material under high strain rates. The comparison between static and dynamic results shows that the specimen toughness increases with loading rates. Relative density increase produce a drop in absorbed energy in dynamic ranges of loading while in static loading condition the opposite of this relation obtained between relative density and energy.

COMPARISON BETWEEN THE EFFECT OF ZR ADDITION TO AL GRAIN REFINED BY TI OR TI+B ON ITS MECHANICAL CHARACTERISTICS IN THE AS CAST AND AFTER EXTRUSION (62)

Safwan M. A. Alqawabah, *safwan_q@yahoo.com*, Mechanical Engineering Department, Tafila Technical University, Amman, Jordan

Adnan I. O. Zaid, *a_kilani43@hotmail.com*, Industrial Engineering Department, University of Jordan, Amman, Jordan.

ABSTRACT

The effect of grain refinement of aluminum and its alloys by rare earth elements on their formability is rare. In this paper, the effect of zirconium addition (at a rate of 0.1% wt. to Al refined by Ti or Ti+B) on its metallurgical, mechanical characteristics and formability in the cast and extruded conditions was investigated. In the cast conditionit was found that addition of Ti+B was a better grain refiner than titanium although boron itself was not a grain refiner when added alone. In absence of Ti or Ti+B, it was found that addition of Zr to Al resulted in. grain coarsening,. The flow stress and ultimate tensile strength were improved for the Al-Ti-B and the Al-Ti-B-Zr microalloys. However, the strain hardening index was increased but the ductility was reduced for all the microalloys. The extrusion process resulted in pronounced refinement of the grain size of Al and all its microalloys. It also resulted in increase of their hardness, flow stress, strain hardening index, and ultimate tensile strength, except for the Al-Ti alloys.

PARTICLE DEPOSITION IN RESIN TRANSFER MOLDING OF ADVANCED COMPOSITES (69)

Tugce Aydil Dalkiran, *tugce.aydil@metu.edu.tr,* Middle East Technical University, 06800, Ankara, Turkey

Hamed Tanabi [1], *htanabi@thk.edu.tr,* University of Turkish Aeronautical Association, 06790, Ankara, Turkey

Hamed Tanabi [2], *tanabi.hamed@metu.edu.tr,* Middle East Technical University, 06800, Ankara, Turkey

Merve Erdal, *merdal@metu.edu.tr,* Middle East Technical University, 06800, Ankara, Turkey

ABSTRACT

In this paper, the impregnation of the fibrous preform with the particle-resin suspension in Resin Transfer Molding (RTM) is modeled through a Darcy law-based porous flow model, coupled with particle filtration kinetics. COMSOL Multiphysics software is used to model the 2-D RTM process. An experimental set-up has been developed and preliminary experiments are performed to compare with model results. The produced specimens are characterized to obtain particle filler distributions. The simulation results are found to match experimental results when filtration kinetics is adjusted through tuning the model parameter, filtration coefficient. To achieve more accurate results, further experimental work is planned to study the effect of processing parameters on the resulting particle distribution.

Keywords: Particle filled advanced composites, Resin transfer molding, Experimental study

DEFORMATION OF SUPER ALLOYS AT ELEVATED TEMPERATURES (77)

M. Oktay ALNIAK, oktay.alniak@eng.bahcesehir.edu.tr Bahçeşehir University, Industrial Engineering Dept., 34353 İstanbul

ÖZET:

Süper alaşımların malzeme yapısını etkileyen malzeme parametreleri malzemenin deformasyonunu modellemek için kullanılabilir. Toz metalürjisi süper alaşımlarının pekiştirilmesi için termo-mekanik işlemler uygulanır. Gerilme ve gerinme ilişkisi deformasyon, deformasyon hızı, tane boyutu, sıcaklık ve benzer parametreler kullanılarak ifade edilebilir. Bu çalışmada, deney metotlarına ve analitik formülasyona dayalı yeni bir deformasyon modeli teklif edilmektedir. Çalışmada Rene 95 süper alaşım malzemesi deneylerde kullanılmış, sabit deformasyon hızında ve yüksek sıcaklıklarda mikro yapısal davranışlar incelenmiştir.

Anahtar Kelimeler: P/M Rene 95, süper alaşımlar, modelleme, deformasyon hızı, bünye denklemi modellemesi

NONLINEAR FREE VIBRATION ANALYSIS OF NONUNIFORM ROTATING DOUBLE WALLED CARBON NANOTUBES (27)

Hamed Samandari, *hamed.samandari@metu.edu.tr* Middle East Technical University, 06800, Ankara, Turkey

Ender Cigeroglu, *ender@metu.edu.tr* Middle East Technical University, 06800, Ankara, Turkey

ABSTRACT

In the present study, nonlinear free vibration of a nonlocal rotating double walled carbon nanotube (DWCNT) is investigated. Since CNTs are capable of undergoing large deformations within the elastic limit, geometric nonlinearity due to large deformation is as well considered. Moreover, the cross-sectional area of the CNTs are assumed to change along the axial direction. Differential quadrature method (DQM) is used to discretize the partial differential equations of motion resulting in a system of nonlinear ordinary differential equations. Using DQM and considering a harmonic solution in time, nonlinear differential equations of motion are converted into a set of nonlinear algebraic equations, which is solved by using an iterative path following method. The effects of the nonlocal parameter, aspect ratio, and diameters of the tubes on the linear and nonlinear natural frequencies of the rotating carbon nanotubes with respect to the rotation speed are studied. The results obtained can provide useful insight for the study and design of nanodevices.

Keywords: Nonlinear vibration, Geometric nonlinearity, Rotating double walled carbon nanotubes, Non-uniform double walled carbon nanotubes, Nonlocal Euler Bernoulli beam theory, Differential quadrature method

CHARACTERİSTİC OF ANCHOR EMBEDDED ON CONCRETE UNDER DİFFERENT LOADİNG RATE (60)

SH. M. Ismael*, W. M. Khair-Aldien, A. A. Kalil and A. A. Nassr

*corresponding author E-mail: aakhalil@aun.edu.eg

ABSTRACT

The effect of anchor embedded length and impact load on the mechanical properties of adhesive concrete joint under different dynamic loading rate was studied [1]. Hopkinson pressure bar was used to apply dynamic load to specimens. Specimens with through hole and embedded anchor lengths of 2.5 cm and 5 cm were used in the study. The specimens were hit with strain wave induced using air pressure of 1 and 1.5 bar respectively. The result showed that as the embedded length decrease the maximum load of failure increase also as the pressure increase the specimen tend to absorb most of the wave in the adhesive joint. While as the load wave magnitude decrease the portion of the wave transmits to the concrete part of the specimen causing rupture or cracking of this part increase.

CONTACT AND BENDING STRESS ANALYSIS OF SPUR GEAR DRIVES (67)

Sadık OLGUNER, olguner@*gantep.edu.tr* University of Gaziantep,27310, Gaziantep, Turkey

İ. Hüseyin FİLİZ, hfiliz@*gantep.edu.tr* University of Gaziantep,27310, Gaziantep, Turkey

ABSTRACT

In this paper, the main purpose is first, to determine contact stress on involute spur gear teeth by using analytical and numerical approaches and compare the result of these approaches. Using specifications of a gear, a model is generated and the process of obtaining the model is automated with a computer program developed in this study. Using data from the model, Hertz contact stresses are determined by using analytical formulation. The same model is used for finite element analysis for obtaining contact stresses by using ANSYS software. For a mesh cycle, variations of contact stresses obtained from the two approaches, are determined for different gear ratios. Except at the contact points of the tip point of pinion with the root of the mating gear, numerical results were in good agreement with the analytical results. It was also noticed that, level of contact stress decreases when gear ratio (or contact ratio) increases. Additionally, in order to see how bending stresses at the root of pinion and gear is varied due to change of contact point in a mesh cycle, bending stress variation is evaluated and included in the content of this study. For different gear ratios, it was noticed that variation of bending stress in a mesh cycle has the same nature with the contact stress variation but magnitudes are smaller with respect to contact stresses.

Keywords: Involute spur gear, Hertz contact stress, Finite element method

A STUDY OF SOME THREE-DIMENSIONAL ISSUES IN MODIFIED ARCAN LOADING DEVICE UNDER MIXED-MODE LOADING CONDITIONS (33)

Abuzar ES'HAGI OSKUI*, *aeoskui@yahoo.com* Sahand University of Technology, Tabriz, Iran

Naghdali CHOUPANI, *choupani@sut.ac.ir* Sahand University of Technology, Tabriz, Iran

Morteza SOLTANPOUR KHAMNEH, *Mo_soltanpour@sut.ac.ir* Sahand University of Technology, Tabriz, Iran

ABSTRACT

In this paper, a modified version of Arcan specimen was employed to investigate mixed-mode loading conditions. Using the FE results, the correction factors were determined via three-dimensional analysis at different in-plane loading angles from 0° to 90°. A full range of mixed-mode loading conditions including pure mode-I and pure mode-II loading were created. According to the results in modified Arcan device there are a large number of unwanted third mode loading conditions because of the asymmetry of Arcan fixture. It is also seen that by increasing in-plane loading angle values of mode-III non-dimensional stress intensity factors increase for modified Arcan device.

Keywords: Fracture mechanics, Mixed-mode, 3D Finite-element analysis, Modified Arcan device

DYNAMICS BEHAVIOR ANALYSIS OF CRACKED SHAFT IN ROTATING MACHINERY (73)

Hamit SARUHAN, *hamitsaruhan@duzce.edu.tr* Düzce University, 81630, Düzce, Turkey

Fikret POLAT, *fikretpolat@duzce.edu.tr* Düzce University, 81630, Düzce, Turkey

Mert KILINÇEL, *mertkilincel@duzce.edu.tr* Düzce University, 81630, Düzce, Turkey

ABSTRACT

This paper presents an experimental study on dynamics behavior of cracked shaft in rotating machinery system. Shaft crack has great potential to cause catastrophic failures in rotating machinery system. Therefore, the detection and analyzing of a shaft crack would potentially avoid severe damage to the system. The experimentally obtained results from the cracked shafts were compared with that of an intact shaft. Evenly spaced a 6-blade paddle fan with unbalance screw was attached to the shafts. The vibration spectrum and amplitude data were captured for four different loading cases. The obtained data from the experiments have analyzed in detail.

Keywords: Shaft crack, Vibration analysis, Rotating machinery

VOID COALESCENCE THROUGH INTERNAL NECKING: THOMASON'S CRITERION REVISITED (78)

Cihan TEKOĞLU, *cihantekoglu@etu.edu.tr* TOBB University of Economics and Technology, 06560, Ankara, Turkey

Sanaz ATTARİ, *s.attari@ymail.com* Gazi University, 06500, Ankara, Turkey

Jean-Baptiste LEBLOND, *jbl@lmm.jussieu.fr* Université Paris VI, 75252 Paris Cedex 05, France

Thomas PARDOEN, *thomas.pardoen@uclouvain.be* Université catholique de Louvain, B-1348 Louvain-la-Neuve, Belgium

ABSTRACT

Tekoğlu *et al*., 2012, improved the criterion of Thomason for void coalescence [Thomason, 1990] by incorporating the effect of shear into the original criterion. In [Tekoğlu *et al*., 2012] the purpose was to determine the plastic limit load required to initiate void coalescence; the void growth phase was out of scope. In this study, however, the effects of void growth and void shape changes on internal necking are investigated through finite element (FE) calculations performed on three dimensional (3D) voided unit cells. In its final form, Thomason's criterion provides accurate predictions in comparison with FE calculations, even when the void growth phase is accounted for.

Keywords: Ductile fracture, Void coalescence, Finite element method, Stress triaxiality, Shear stress

EXPERIMENTAL VIBRATION ANALYSIS OF SIMULATED SHAFT CRACK (86)

Hamit SARUHAN, *hamitsaruhan@duzce.edu.tr* Düzce University, 81630, Düzce, Turkey

Mert KILINÇEL, *mertkilincel@duzce.edu.tr* Düzce University, 81630, Düzce, Turkey

Fikret POLAT, *fikretpolat@duzce.edu.tr* Düzce University, 81630, Düzce, Turkey

ABSTRACT

In the present study, the flange-simulated cracked shaft which consists of two separable shafts joint at mating flanges was used for vibration analysis of shaft crack. Four bolts which can be loosened or fastened in a pattern to simulate varying stiffness of the shaft were used. Shaft crack has great potential to cause sudden failure in the rotating machinery system. Therefore, the detection and analyzing of a shaft crack would potentially avoid severe damage to the system. The vibration amplitude data were captured and analyzed for five tests cases. Sixteen experimental setups were employed for each of the test cases.

Keywords: Cracked shaft, Vibration amplitude, Vibration analysis, Rotating machinery

TÜRKÇE BİLDİRİLER
(İngilizce Özetlerle)

PAPERS IN TURKISH
(with English Abstracts)

KALIP DEĞİŞİMLERİNDE HİDROLİK SABİTLEYİCİ KULLANILMASININ AVANTAJLARI (6)

Ersel ÖZDEN, *ozdene@toyotetsu.com.tr* Toyotetsu-Türkiye, 41420, Kocaeli
Ebru TAŞKIN, *taskine@toyotetsu.com.tr* Toyotetsu-Türkiye, 41420, Kocaeli
Orçun YÖNTEM, *yontemo@toyotetsu.com.tr* Toyotetsu-Türkiye, 41420, Kocaeli
R.Güçlü ARIKAN, *arikang@toyotetsu.com.tr* Toyotetsu-Türkiye , 41420, Kocaeli

ÖZET

Otomotiv endüstrisinde artan rekabet ortamına bağlı olarak üretim proseslerinde maliyet indirimleri oldukça önem kazanmıştır. Seri üretim koşullarına uygun olarak yapılacak her iyileştirmenin maliyet üzerindeki etkisi önem arz ederken proses iyileştirmeleri şirketlerin karlılık politikalarında ana başlık olarak yerlerini korumaktadır. Bunun yanında insan gücünün sürekliliğinin sağlanması en önemli noktadır. Pres üretimlerinde bu iki konu kalıp değişim metotlarında birleşmektedir. Bundan dolayı, kalıp değişim methodunda yapılan iyileştirmeler, ergonomi ve de maliyet indirimlerini doğrudan etkileyecektir. Bu makalede hızlı kalıp değişim yöntemleri ve hidrolik sabitleyiciler incelenmiştir.

Anahtar Kelimeler: Hidrolik Sistemler, Hızlı Kalıp Değişimi, Ergonomi

ABSTRACT

Cost reductions in production processes have gained importance due to increasing competitions in the automotive industry. Every improvements which have been done accordingly mass production conditions are having importance on cost reduction policy, consequently cost reductions in production processes are maintaining their places as the main title in company policies. Besides, ensuring of continuity of human force is the most important point. During press productions, these two issues are combining in die changing methods. Therefore, improvements which have been done on die changing methods, will be directly affect on ergonomy and cost reduction. In this article, quick die change methods and hydraulic clamps have been discussed.

Keywords: Hydraulic Systems, Quick Die Change, Ergonomy

OTOMOTİV ENDÜSTRİSİNDE KULLANILAN 3 BOYUTLU PARÇALARIN KESİMİ İÇİN LAZER KESİM TEZGÂHLARI (9)

Hakan DEMİR, *hdemir@coskunoz.com..tr* COŞKUNÖZ METAL FORM A.Ş. OSB Mavi Cadde, No:5 PK:16140 Bursa / TÜRKİYE
Tayfun SIĞIRTMAÇ, *tsigirtmac@coskunoz.com..tr COŞKUNÖZ METAL FORM A.Ş. OSB Mavi Cadde, No:5 PK:16140 Bursa / TÜRKİYE*

ÖZET

Otomotiv endüstrisinde lazer kesim, prototip parça geliştirme sırasında kalıp maliyetlerini azaltmak, seri parça üretiminde kullanılan yüksek mukavemetli kalıp ile kesilmesi zor olan DP serisi veya sıcak şekillendirilmiş sacların çevre kesme ve delik delme operasyonlarınının gerçekleştirilebilmesi için kullanılmaktatır.

Parçalar prototip geliştirme sırasında üretilebilirlik, fonksiyonellik gibi nedenlerle çok defa revize edilmektedir. Parça değişikliği çoğunlukla operasyon kalıplarında da değişikliği zorunlu kılmaktadır. Bu durumun önüne geçmek için prototip geliştirme sürecinde kesme ve boşaltma operasyonlarının lazer ile yapılması tercih edilmektedir. Seri üretime geçildiğinde özellikle yüksek adetli üretimlerde bütün operasyonlar kalıp ile gerçekleştirilmektedir. Traktör kabini, kamyon ve otobüs gibi nispeten üretim adetleri düşük olan alanlarda 3D lazer kesim birim parça maliyetini azaltmak için de tercih edilmektedir. Özellikle otobüs ve kamyon parçalarının üretildiği kalıplar hacimsel olarak büyük olduklarından operasyon kalıbı adetlerinin azaltılması maliyetleri düşürebilmek için önemlidir.

Seri üretim araç gövdelerinde kullanılan yüksek mukavemetli şekillendirilmesi, özellikle kesilmesi zor DP(Dual Phase)-600, DP-800 sacların ve sıcak şekillendirilmiş parçaların çevre kesme ve delik delme operasyonları teknik gereklilikler nedeni ile lazer kesim ile gerçekleştirilir.

Lazer teknolojisindeki gelişmeler, özellikle fiber lazerlerin endüstriyel kullanımının artması ile lazer kesim uygulamaların otomotiv endüstrisindeki kullanım alanlarının genişlemesi beklenmektedir.

Anahtar Kelimeler: 3D Lazer Kesim, Sıcak Şekillendirme, 5 Eksen Lazer Kesim Tezgahları

ABSTRACT

Laser cutting in the automotive industry is used to reduce die costs during development of prototype parts, is used for trimming and drilling of serial parts made from high-strength DP(dual phase) steels or hot-formed steels which have difficulties for cutting with common die operations.

Prototype parts are revised due that a lot of reasons such as productivity, functionality. Revised prototypes usually cause the change of operation dies. In order to prevent these changes, laser cutting is prefered during the development of prototype. In mass production, all of the operations are taken place with dies.3D Laser cutting is recommended to reduce unit prices for low-volume productions such as caterpillar cabs, trucks, buses. To decrease the number of dies with high-volume for especially parts of trucks and buses is significant to reduce costs.

Increase of laser cutting applications in automotive industry is expected due to the development on laser technologies and increase of industrial fiber laser applications.

Keywords: 3D Laser Cutting, Hot Forming, 5 axis Laser Cutting Machine

HOTMELT TEKNOLOJİSİ İLE ENKAPSÜLASYON UYGULAMASI VE ELEKTRONİK DONANIM GÖVDELENDİRME ÖRNEK PROSES İNCELEMESİ (25)

Burhan ÖZUĞUR, *burhan.ozugur@robust.com.tr* Robust Elektronik Yazılım Danışmanlık Sanayi Ticaret Limited Şirketi, 06370, Ankara
Serhat APAK, *serhat.apak@ww-turkiye.com* Werner Wirth Elektronik Koruma Sistemleri Sanayi Ticaret Limited Şirketi, 06370, Ankara

ÖZET

Ürün geliştirme süreçlerinde gerçekleştirilen tasarım faaliyetleri ile birlikte tercih edilen üretim yöntemi de ürün kalitesini birincil derecede etkileyen unsurdur. Yüksek kaliteli ve belirlenen tasarım kriterlerine uygun nitelikte ürün elde etmek için kullanılan üretim yöntemlerinden biri de hotmelt teknolojisidir.

Bu çalışmada, hotmelt teknolojisinin genel özellikleri ve bu yöntemin kullanılması ile elde edilebilecek faydalar irdelenmiştir. Örnek bir uygulama üzerinde hotmelt teknolojisinin proses detayları ve uygulama sonucunda varılan nokta görsel anlatımla sunulmuştur.

Anahtar Kelimeler: Hotmelt, Elektronik, Enkapsülasyon

ABSTRACT

The production methods used such as product design are also important factors affecting product quality. High-quality products that meet the design criteria and target production methods to produce one of the hotmelt method.

In this study, the general properties of hotmelt technology and the benefit of this method have been investigated. On a case study, hotmelt process visually examined and the examination results are given.

Keywords: Hotmelt, Electronic, Encapsulation, Overmolding

DÜZE ANA DELİK ÇAP DEĞERLERİNİN HAVA AKIMI VE İPLİK TÜYLÜLÜĞÜ ÜZERİNDEKİ ETKİLERİ (45)

D. YILMAZ, *demetyilmaz@sdu.edu.tr* Süleyman Demirel Üniversitesi, 32260, Isparta
M.R. USAL, *resitusal@sdu.edu.tr* Süleyman Demirel Üniversitesi, 32260, Isparta

ÖZET

Bu çalışmada, tekstil iplik eğirme prosesinde kullanılan ve üç farklı ana delik çapına sahip bir hava düzesi içerisinde meydana gelen dönen hava akımı simüle edilmiş ve hız, basınç, debi gibi özellikler sayısal metotlarla analiz edilmiştir. Çalışmada, sonlu hacim metoduna dayanan ANSYS 12.0 “Fluid Flow” paket programı kullanılmıştır. Simülasyonda, literatürden farklı olarak sınır tabakalı akışlarda iyi sonuç veren SST türbülans modeli seçilmiş, düze içerisindeki ipliğin varlığı çözüme dahil edilmiş ve deneysel ölçümlerden elde edilen veriler sınır şartları olarak kullanılmıştır. Çalışma sonucunda, düze tasarım sürecini kısaltmak açısından iplik özellikleri üzerinde etkili tipik hava akımı davranışları belirlenmeye çalışılmıştır.

Anahtar Kelimeler: Düze, basınçlı hava, sayısal simülasyon, ANSYS, tüylülük.

ABSTRACT

In this study, swirling airflow in an air nozzle used in textile yarn spinning process was simulated and its properties such as velocity, pressure and mass flow was analyzed. In numerical simulation, ANSYS Fluid Flow (CFX) analysis method was used. Different from the literature, in the simulation, Shear Stress Turbulent (SST) model was preferred due to its better performance in boundary layer flows, the yarn was included to the numerical analysis and experimental data were used for boundary condition. At the end of the study, in order to shorten the nozzle design process, it was focused on defining the effective airflow behaviour on yarn properties.

Keywords: Nozzle, pressurized air, numerical analysis, ANSYS, hairiness.

METAL ŞEKİLLENDİRME PROSESİ ÜZERİNDEN GERİ ESNEME TELAFİ YÖNTEMLERİNİN İNCELENMESİ (FO1)

Emre ESENER, *emre.esener@bilecik.edu.tr* Bilecik S.E. Üniversitesi, Bilecik, Türkiye
Mehmet FIRAT, *firat@sakarya.edu.tr* Sakarya Üniversitesi, Sakarya, Türkiye

ÖZET

Geri esneme, özellikle otomotiv endüstrisinde kullanılan sac metal şekillendirme proseslerinde en sık görülen problemlerin başında gelmektedir. Geri esneme malzeme üzerindeki kuvvet kaldırıldığında geometride şekil bozukluğuna neden olmaktadır. Bu çalışmada, endüstriyel bir ürün olan tavan destek sacı parçası üzerinden geri esneme telafisi yöntemleri incelenmiştir. Geri esneme, proses parametrelerinin etkisi ve kalıp yüzeyi telafisi ile azaltılmıştır. Modelleme ve telafi aşamalarında Catia, sonlu elemanlar analizlerinde ise Dynaform yazılımları kullanılmıştır.

Anahtar Kelimeler: Geri esneme, sonlu elemanlar analizi, deneysel tasarım.

ABSTRACT

Sheet metal forming processes has been widely used as mass production tool especially in automotive and related industries. There are many manufacturing problems when considering sheet metal stamping parts. These may occur due to complexity of product geometry or formability related concerns such as tearing, wrinkling etc. Shape distortion problems like springback is another issue encountered during production.Springback causes geometry deflection after removing the die tools. In this study, springback compensation methods were discussed on an industrial roof stiffener part. Springback compensation was investigated by the effects of process parameters and displacement adjustment. Catia software was used at modelling and compensation stages and Dynaform software was used at finite element analysis.

Keywords: Springback, finite element analysis, desgin of experiment.

TAKIM TEZGÂHLARINDAKİ BİLYALI VİDALI MİL HAREKET SİSTEMİNİN EKSENEL VE BURULMA TİTREŞİMLERİNİN İNCELENMESİ (24)

Muhammet ERDÖL, *merdol@gyte.edu.tr* Gebze Yüksek Teknoloji Enstitüsü, 41400, Kocaeli
Hasan KURTARAN, *hasan@gyte.edu.tr* Gebze Yüksek Teknoloji Enstitüsü, 41400, Kocaeli

ÖZET

Bu çalışmada takım tezgahlarındaki bilyalı vidalı mil hareket sisteminin eksenel ve burulma serbest titreşimleri incelenmiştir. Serbest titreşimlerin incelenmesinde sonlu elemanlar yöntemi kullanılmıştır. Vida hatvesi, vida çapı, ön gerilme kuvveti, tablanın konumu gibi parametrelerin titreşim frekansları üzerindeki etkileri incelenmiş ve önem dereceleri belirlenmiştir. Parametrelerin önem derecelerinin belirlenmesinde 3 Seviyeli Tam Faktöriyel Deney Tasarımı ve Varyans Analizi (ANOVA) yöntemleri kullanılmıştır.

Anahtar Kelimeler: Takım Tezgahı, Bilyalı Vidalı Mil Hareket Sistemi, Serbest Titreşim, Sonlu Elemanlar

ABSTRACT

In this study, axial and torsional free vibration behavior of ball screw drive system in machine tools are investigated. Finite element method is used in investigating free vibration. Effect of parameters such as screw pitch, screw diameter, preload force, table position on frequencies of free vibration is analyzed. Parametric studies are conducted using 3-Level Full Factorial Design of Experiment and Analysis of Variance (ANOVA) methods.

Key Words: Machine Tools, Ball Screw Drive System, Free Vibration, Finite Elements

PETEK YAPILI SANDVİÇ YAPILARIN DİNAMİK ÖZELLİKLERİNİN İNCELENMESİ (32)

M. Fatih ŞANSVEREN, *f.sansveren@atauni.edu.tr* Atatürk Üniversitesi, 25240, Erzurum
Alparslan YİĞİT, *alparslan@atauni.edu.tr* Atatürk Üniversitesi, 25240, Erzurum
Mustafa YAMAN, *myaman@atauni.edu.tr* Atatürk Üniversitesi, 25240, Erzurum

ÖZET

Mühendislik uygulamalarında gün geçtikçe daha iyi mekanik özellikleri sahip olan malzemelere ihtiyaç duyulur. Yeterli dayanım ve daha fazla enerji yutma özelliği (sönümleme kapasitesi) olan malzeme temini de bunlardan biridir.

Bu çalışmada, alüminyum dikdörtgen şeklindeki bal peteği sandviç kompozit yapının, serbest titreşim analizi sonlu eleman yöntemi kullanılarak gerçekleştirilmiştir. Ankastre-serbest sınır şartlarına maruz farklı konfigürasyonlardaki sandviç yapının doğal frekansları, titreşim biçimleri ve sönüm oranları belirlenmiştir. Sandviç yapıyı oluşturan yüzey plaka kalınlıklarının ve sandviç yapısının kalınlığının titreşim karakteristiklerine ve sönüm oranına etkileri incelenmiştir. Sayısal analizler ANSYS paket programı ile gerçekleştirilmiştir.

Anahtar Kelimeler: kompozit, balpeteği, sandviç yapı, titreşim analizi

ABSTRACT

In engineering applications, materials having better mechanical properties are needed day by day. Sufficient strength and more energy absorption capability (damping capacity) have a great importance in terms of material supply.

In this study, free vibration analyses of aluminium rectangle shaped composite honeycomb structure were carried out by using finite element method. The natural frequencies, vibration modes and damping ratio of structures fabricated with different configurations for clamped-free boundary conditions were determined. The effects of lower and upper face sheet thickness and the core material (the thickness of sandwich structure) on the vibration characteristics and damping ratios were examined. The numerical analysis were carried out with ANSYS program.

Keywords: composite, honeycomb, sandwich structure, vibration analysis

ALÜMİNYUM MATRİSLİ FONKSİYONEL DERECELENDİRİLMİŞ MALZEMEDE ÇATLAK İLERLEYİŞİNİN DENEYSEL ANALİZİ (37)

Arzum ULUKÖY, *aulukoy@pau.edu.tr* Pamukkale Üniversitesi, 20070, Denizli
Muzaffer TOPÇU, *mtopcu@pau.edu.tr* Pamukkale Üniversitesi, 20070, Denizli
Süleyman TAŞGETİREN, *tasgetir@aku.edu.tr* Afyon Kocatepe Üniversitesi, 03200, Afyonkarahisar

ÖZET

Pek çok mühendislik uygulamasında istenilen özellikler, metal matrisli kompozitlerle elde edilmektedir. Alüminyum alaşımları hafifliği, yüksek dayanım ve tokluğu, iyi korozyon özellikleri, yaşlandırma ile dayanımının artırılabilirliği gibi özelliklerinden dolayı özellikle otomotiv, havacılık ve savunma sanayinde geniş bir kullanım alanı bulmakta; süneklik ve sertlik, geliştirilmiş dayanım ve rijitlik kombinasyonu nedeniyle metal matrisli kompozitler için matris malzemesi olarak tercih edilmektedir.

Bu çalışmada, 2014 alüminyum alaşımı ile SiC tanecikleri karıştırılarak savurma döküm yöntemi ile dökülerek fonksiyonel derecelendirilmiş bir malzeme elde edilmiştir. SiC dağılımı ve et kalınlığına bağlı olarak mekanik özellikler et kalınlığı boyunca farklılık göstermiştir. SiC dağılımının yorulma çatlağı ilerlemesine etkisini incelemek amacıyla R=0.1 gerilme oranında ve çekme yükü altında yorulma çatlağı ilerlemesi deneyleri yapılmıştır. Yorulma çatlağı ilerlemesi deneyleri için 3 ayrı grup halinde numune hazırlanmıştır. 1. grup numuneler malzemenin et kalınlığı boyunca tabakalar halinde bölünmesi ile elde edilmiş ve merkez

çentikli (Middle Tension, M(T)) hazırlanmıştır. SiCce zengin olan ve olmayan taraflar arasında çatlak ilerlemesi parametrelerinin değişimini görebilmek amacıyla 2. grup numunelere SiCce zengin tarafa, 3. Grup numunelere ise alüminyumca zengin olan tarafa çentik (Single Edge Tension, SE(T)) açılmıştır. Merkez çentikli numunelerin yorulma çatlak ilerlemesi davranışı farklı olmuştur. Alüminyumca zengin olan kısımdan SiCce zengin olan tarafa ilerledikçe, çatlak başlangıcı ve ilerlemesi gecikmiştir. Numunelerin SiC oranı arttıkça, tekrar sayısı %350'lere varan oranlarda artmıştır. SiCce zengin ve alüminyumca zengin taraflardan başlayan kenar çatlakların ilerleyişleri farklı olmuştur. SiCce zengin olan tarafta, çatlak ucundan ilerleme hem daha geç başlamış hem de daha uzun bir sürede kırılma olayı gerçekleşmiştir. Yorulma ömrü %500'e kadar artmıştır.

Anahtar Kelimeler: Fonksiyonel derecelendirilmiş malzeme, SiC, alüminyum 2014, çatlak ilerlemesi, yorulma ömrü

EXPERIMENTAL INVESTIGATION OF CRACK PROPAGATION IN ALUMINUM MATRIX FUNCTIONALLY GRADED MATERIAL

ABSTRACT

The required characteristics in many different engineering applications are obtained by metal matrix composites reinforced with ceramic particles. Aluminum alloys are preferred particularly for using in the automotive, aerospace, and defense industries due to their light weight, good corrosion resistance, and strength expandability via aging. Since they have the combinations of ductility-toughness, and strength-rigidity, aluminum alloys are commonly selected as the matrix material.

A functionally graded cylindrical specimen was obtained via centrifugal casting by SiC particles mixed with 2014 aluminum alloy. The distribution of SiC and the mechanical properties of material varied through its wall thickness. Fatigue crack growth experiments was done to investigate the effect of SiC distribution on the crack propagation under the tensile load with stress ratio R = 0.1. The samples were prepared in three separate groups: A cylindrical specimen was cut through its thickness via vertical slicing, and central notch (Middle Tension, M(T)) was opened (1); in order to determine of crack propagation parameters variation, single edge notches were opened SiC-rich side (2), and aluminum-rich side (3) of specimens. The fatigue crack propagation of central notched specimens varied depending on SiC distributions, and the crack initiation and progression were delayed via increasing SiC ratio. The obtained fatigue life rose up to 350% under the same conditions. It was obtained different propagation behaviors for SiC-rich and aluminum-rich side notched specimens. The fatigue cracks were formed on the SiC-rich side notched specimens later than the aluminum-rich side notched specimens, and its fatigue life rose up to 500% compared with aluminum-rich side notched specimens.

Keywords: Functionally graded material, Aluminum 2014, Crack propagation, Fatigue life

ELEKTROLİTİK ve ALAŞIM BAKIR ELEKTROTLARIN ELEKTRO-EROZYON İLE İŞLEME PERFORMANSINA ETKİSİ (15)

Ülke ŞİMŞEK, *ulkesimsek@gmail.com* ODTÜ, Balgat, 06530, Ankara.
Can ÇOĞUN, *cogun@cankaya.edu.tr* Çankaya Üniversitesi, 06810, Ankara.

ÖZET

Elektro erozyon ile işlemenin (EEİ) en önemli maliyet unsuru elektrotun üretilmesidir. EEİ'de en yaygın kullanılan elektrot malzemeleri bakır ve alaşımlarıdır. Maliyeti arttırmadan EEİ yapmanın yolu, hammadde maliyeti düşük, işlemesi kolay ve elektriksel aşınma direnci yüksek bakır alaşımlarını tespit etmektir. Bu çalışmada, EEİ'de elektrot olarak kullanılan elektrolitik bakır, CuCr1Zr ve CuCo2Be bakır alaşımları için işleme hızı, elektrot aşınma hızı, bağıl aşınma ve işparçası yüzey pürüzlülüğü gibi performans çıktıları deneysel olarak incelenmiştir. Ayrıca, CuCr1Zr alaşımına uygulanan yaşlandırma işlemi sonrası artan elektriksel iletkenliğin EEİ performans çıktılarına etkileri incelenmiştir. Performans çıktılarının alaşım türünden ve uygulanan yaşlandırma işleminden etkilendiği görülmüştür.

Anahtar kelimeler: elektro erozyon ile işleme, elektrot, bakır alaşımı, işleme hızı, elektrot aşınması, yüzey pürüzlülüğü.

ABSTRACT

The most important cost element for the process of the electric discharge machining (EDM) is the production cost of electrodes. In EDM process, copper and its alloys are commonly used as electrode materials. The way of machining with EDM without increasing the costs can be achieved by selecting the proper copper alloy having low material cost and high electrical wear resistance. In this study, the EDM performance outputs, namely workpiece removal rate, relative wear and workpiece surface roughness, were experimentally investigated for electrolytic copper, CuCr1Zr and CuCo2Be electrode materials. Also, effect of aging of CuCr1Zr alloys, resulting in increasing electrical conductivity, on the performance outputs in EDM process were examined. The performance outputs found to be affected by the types of copper alloy and the applied aging treatment.

Keywords: Electric discharge machining, electrode, copper alloy, removal rate, electrode wear, surface roughness.

SAÇ MODELLEME: FONKSİYONEL PARÇALARIN İMALATI İÇİN EKLEMELİ İMALAT YÖNTEMİ (28)

Uğur ERKEN, *erken@itu.edu.tr*, İstanbul Teknik Üniversitesi, İmalat Mühendisliği Bölümü, İstanbul, Türkiye
Hasan Erdem HARMAN, *harman@itu.edu.tr*, İstanbul Teknik Üniversitesi, İmalat Mühendisliği Bölümü, İstanbul, Türkiye
Serdar SEÇKİN, *seckin@itu.edu.tr*, İstanbul Teknik Üniversitesi, İmalat Mühendisliği Bölümü, İstanbul, Türkiye
Emin Faruk KEÇECİ, *kececi@itu.edu.tr*, İstanbul Teknik Üniversitesi, İmalat Mühendisliği Bölümü, İstanbul, Türkiye

ÖZET

Bu çalışma kapsamında mevcut imalat yöntemlerine alternatif olarak Saç Modelleme diye adlandırılan yeni bir imalat yöntemi sunulmuştur. Bu yöntemin en büyük avantajı parçaların daha hafif olarak imal edilmesine olanak vermesidir. İmalat yöntemin çalışma prensibi açıklandıktan sonra 5 farklı fonksiyonel makina parçası için yöntem uygulanmış ve parçalar imal edilmiştir. Yapılan bilgisayar analizleri ile yöntem sayesinde gerçekleştirilen hafifletme ve buna bağlı olarak değişen dayanım değerleri bulunmuştur. Ayrıca yapılan basma deneyi ile de bu yöntem ile imal edilen makina parçasının dayanımı deneysel olarak ispat edilmiştir.

Anahtar Kelimeler: Saç modelleme, bilgisayar destekli imalat, yapısal analiz.

ABSTRACT

In this study a new manufacturing method, namely Layering is proposed alternative to the current manufacturing methods. The most important advantage of this method is to manufacture lighter parts. After the principle of the new manufacturing method is explained, 5 most common mechanical parts are manufactured. With the computer analysis the weight reduction and strength change is calculated. With an compression test the methodology and the manufactured part is tested experimentally.

Keywords: Layering, computer integrated manufacturing, structural analysis.

LAZER OYMA İŞLEMİNİN WC-Co YÜZEY ÖZELLİKLERİNE ETKİLERİNİN ARAŞTIRILMASI (29)

Şefika KASMAN, *sefika.kasman@deu.edu.tr* Dokuz Eylül Üniversitesi, 35160 İzmir, Türkiye
İ.Etem SAKLAKOĞLU, *i.e.saklakoglu@ege.edu.tr* Ege Üniversitesi, 35100, İzmir, Türkiye

ÖZET

Bu çalışmada Tungsten karbür kobalt malzemenin yüzeyinde lazerle oyma işlemi gerçekleştirilmiştir. Artan hız ve azalan güç ile birlikte yüzey pürüzlülüğünde azalma neticesinde oyuk içi yeniden katılaşmış tabakanın kalınlığında azalma meydana gediği tespit edilmiştir. Yüzey pürüzlülüğü ve oyma derinliği için en uygun koşullar istatistiksel olarak belirlenmiş ve yüzey pürüzlülüğü için en uygun koşul 18W, 400mm/s, 20KHz ve 0,03mm olarak tespit edilirken oyma derinliği için en uygun koşul 30W, 200mm/s, 20KHz ve 0,02mm olarak tespit edilmiştir.

Anahtar kelimeler: Tungsten Karbür, Lazer oyma

INVESTIGATION OF THE EFFECTS OF LASER ENGRAVING ON WC-Co

ABSTRACT

In this study, the laser engraving was performed on the surface of Tungsten carbide - cobalt material. It was detected that, increased in scan speed and decreased in power were caused to decrease in the re-solidified layer thickness in the cavity. The optimum conditions for surface roughness and engraving depth were statistically analyzed and showed that 18W, 400mm/s, 20KHz and 0,03mm was detected as optimum condition for surface roughness and 30W, 200mm/s, 20KHz and 0,02mm was detected as optimum condition for engraving depth.

Keywords: Tungsten carbide, laser engraving

SERT MALZEMELERİN TORNALAMASI İŞLEMLERİNDE TAKIM AŞINMASINI ETKİLEYEN FAKTÖRLERİN TEPKİ YÜZEYİ METODOLOJİSİ İLE BELİRLENMESİ (21)

Dilek MURAT, *dilekm@uludag.edu.tr* Uludağ Üniversitesi, 16049, Bursa, Türkiye
M. Cemal ÇAKIR, *cemal@uludag.edu.tr* Uludağ Üniversitesi, 16059, Bursa, Türkiye
Necmi GÜRSAKAL, *gursakal@uludag.edu.tr* Uludağ Üniversitesi, 16059, Bursa, Türkiye
Ali ORAL, *alioral@balikesir.edu.tr* Balıkesir Üniversitesi,10145, Balıkesir, Türkiye

ÖZET

Bu çalışmada, çekirdeğine kadar 62 HRC sertliğine sertleştirilmiş soğuk iş takım çeliği iş parçalarının (AISI D2) seramik takımlarla (CNGA 120404 KY4400) tornalanması işlemlerinde takım ömrü – işleme parametreleri (V_c, f, a_p) ilişkisinin tepki yüzeyi metodolojisinde kullanılan merkezi bileşik tasarım yardımıyla modellenmesi ve analizi yapılmıştır. Çalışma sonunda, takım aşınması üzerinde etkili olan işleme parametreleri belirlendikten sonra optimum takım aşınması değeri ve bu değere ulaşmak için gerekli faktör seviyelerine ulaşılmıştır.

Anahtar Kelimeler: Sert malzeme tornalama, Takım aşınması, Tepki yüzeyi metodolojisi, Merkezi bileşik tasarım

ABSTRACT

In this work, correlations between the tool life and cutting parameters (V_c, f, a_p) are modelled and analysed using Central Composite Design (CCD) of Response Surface Methodology (RSM) in hard part turning operations of cold work tool steel (AISI D2) hardened to 62 HRC upto its core. Ceramic inserts (CNGA 120404 KY4400) are used in the operations. Thus, cutting parameters that have influence on tool wear are determined and optimum tool wear values, as well as the parameter values that give these optimum values are observed.

Keywords: Hard turning, Tool wear, Response surface methodology, Central composite design.

55 HRC SERTLİKTEKİ AISI H13 TAKIM ÇELİĞİNİN YÜKSEK İLERLEME İLE FREZELENMESİNDE OLUŞAN TAKIM AŞINMASI - KALICI GERİLME İLİŞKİSİNİN ARAŞTIRILMASI (23)

Selim KOCA *selim.koca@fekaautomotive.com* Feka Otomotiv A.Ş., 16049, Bursa
M. Cemal ÇAKIR *cemal@uludag.edu.tr* U. Ü. Mühendislik Fakültesi, 16059, Bursa

ÖZET

Bu çalışmada, 55 HRc sertliğe sahip DIN1.2344 ESR kalıp çeliğinden hazırlanan deney numunelerine cep açma işlemi CNC dik işleme tezgahında gerçekleştirilmiştir. 3 farklı kesme hızı ve 5 farklı diş başı ilerleme değeri kullanılmıştır. İşleme sonunda takım aşınmaları mikroskop yardımıyla tespit edilmiştir. Ardından deney numuneleri üzerindeki kalıcı gerilmeler X-ray ve delik delme metodu kullanılarak saptanmıştır.

Anahtar Kelimeler: Sertleştirilmiş takım çelikleri, talaşlı imalat, kalıcı gerilme

ABSTRACT

In this study, test samples of hardened tool steel with 55 HRc hardness were subjected to pocketing operation in a CNC vertical milling machine. 3 different cutting speeds and 5 different feed rates were used and tool wear was determined by a microscope. Residual stress on the machined test specimens was then determined by X-Ray deflection and hole drilling methods.

Keywords: Hardened tool steels, metal cutting, residual stress

FARKLI SOĞUTMA ŞARTLARI İLE FARKLI KESME PARAMETRELERİNİN AA7075 VE AA2024 ALÜMİNYUM ALAŞIMLARINDA DELİK DELME İŞLEMLERİNE ETKİSİNİN DENEYSEL OLARAK İNCELENMESİ (41)

Ayşegül ÇAKIR, *aycakir@tai.com.tr*, Türk Havacılık ve Uzay Sanayi, 06980, Ankara
Onur BAHTİYAR, *obahtiyar@tai.com.tr*, Türk Havacılık ve Uzay Sanayi, 06980, Ankara
Ulvi ŞEKER, *useker@gazi.edu.tr*, Gazi Üniversitesi, 06170, Ankara

ÖZET

Talaşlı imalatta, iyi bir kesme performansı için; kesme bölgesinde oluşan ısının kontrolü ve çıkan talaşın sorunsuz bir şekilde uzaklaştırılması konusunda kesme (soğutma) sıvısı uygulamaları büyük önem arz eder. Bu çalışmada delik delme işleminde işlenen malzeme, kesme parametresi ve kesme sıvısı uygulamaları (soğutma şartı) gibi faktörlerin kesici takıma olan etkisi incelenmiştir. Bu etkilerin değerlendirilmesi amacıyla AA7075 ve AA2024 alüminyum alaşımlarının delinmesinde dört farklı kesme hızı ve dört farklı ilerleme oranı kullanılarak, geleneksel soğutma ve basınçlı hava ile soğutma olmak üzere iki farklı soğutma şartında deneyler gerçekleştirilmiştir. Deneyler sonunda uygulanan soğutma sıvısının takımdaki yükleri azaltmada açık bir etkisinin olduğu görülmüştür. Ayrıca artan ilerleme oranları ve ilerleme hızlarının, delme işlemlerinde büyük öneme haiz olan ilerleme kuvvetlerini artırırken, artan kesme hızının ise ilerleme kuvvetlerinini düşürdüğü görülmüştür.

Anahtar kelimeler: Alüminyum alaşımları, delik delme, soğutma uygulamaları, ilerleme kuvveti

ABSTRACT

In machining, for a good cutting performance, cutting fluid applications are so important in terms of heat control and smooth removal of the chips produced in cutting area. In this study, the effects of the factors such as; the type of material to be processed, the cutting parameters and cutting fluid applications on the cutting tool are researched. For the purpose of assessing the effects of the these factors, AA2024 aluminum alloys were subjected to drilling machine cutting process in four different cutting speeds, using two different feed rates and two different cooling condition which applied conventional cooling, and cooling with pressure air. In the result of the experiment, it was observed that the cutting fluid applied has an obvious effect on reducing the load on the cutting tools. Also, it has been noted that the increasing feed rate and feed speed increase the thrust forces that have very important feature in drilling process, but the increasing cutting speed decreases the thrust forces.

Keywords: Aluminum alloys, drilling, cooling applications, thrust force

AISI H13 TAKIM ÇELİĞİNİ YÜKSEK HIZLI İŞLEME PARAMETRELERİNİN TAGUCHİ YÖNTEMİYLE OPTİMİZASYONU VE YAPAY SİNİR AĞLARIYLA YÜZEY PÜRÜZLÜLÜĞÜ TAHMİNİ (57)

Mustafa HAMAMCI, *mhamamci@erciyes.edu.tr* Erciyes Üniversitesi, 38039, Kayseri
E. Sabri TOPAL, *topal@erciyes.edu.tr* Erciyes Üniversitesi, 38039, Kayseri

ÖZET

Bu çalışmada AISI H13 sıcak iş takım çeliği, TiAlN kaplı freze takımı ile kuru şartlarda, yüksek iş mili hızlarında frezelenmiş ve farklı seviyedeki işleme parametrelerinin yüzey pürüzlülüğü üzerindeki etkileri araştırılmıştır. Minimum yüzey pürüzlülüğünü sağlayan işleme parametreleri Taguchi deney tasarım metodu kullanılarak belirlenmiştir. Belirlenen optimum işleme parametreleriyle oluşacak yüzey pürüzlülüğü, önceden eğitilen Yapay sinir ağlarıyla (YSA) tahmin edilmiştir. Oluşturulan ağın performansı hataların karesinin ortalaması alınarak ölçülmüştür. Yapılan doğrulama deneyleri sonunda ortalama yüzey pürüzlülüğü (Ra) başarılı bir şekilde iyileştirilmiş ve geliştirilen modelin etkili şekilde tahminde bulunduğu gözlenmiştir.

Anahtar Kelimeler: Yüksek Hızlı İşleme, Yüzey Pürüzlülüğü, Taguchi Metodu, Yapay Sinir Ağları, Optimizasyon.

OPTIMIZATION OF MILLING PARAMETERS AND SURFACE ROUGHNESS PREDICTION IN HIGH SPEED MACHINING OF AISI H13 TOOL STEEL USING TAGUCHI METHOD AND ARTIFICIAL NEURAL NETWORK

ABSTRACT

In this study, AISI H13 hot work tool steel was milled at high spindle speeds by using a TiAlN coated flat end mill without using coolant and the effects of the different cutting parameters levels on surface roughness were investigated. The optimum cutting parameters providing the minimum surface roughness were determined by using Taguchi experimental design method. Surface roughness, resulted after implementation of optimal cutting parameters, was estimated by artificial neural network which previously trained. The performance of created artificial neural network (ANN) was measured with the mean square error (MSE). At the end of the confirmation experiments average surface roughness (Ra) was successfully improved and it was observed that the developed model could predict effectively.

Keywords: High speed machining, Surface roughness, Taguchi method, Artificial neural networks, Optimization.

AUTHORS INDEX