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CONFERENCE PROGRAMME AND BOOK OF ABSTRACTS

umtik 2010

29 June- 2 July, 2010

Güzelyurt- METU NCC – T.R. NORTHERN CYPRUS

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

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Organizing Committee

Metin AKKÖK	(METU, Dept. Of Mechanical Eng.)	akkok@metu.edu.tr
Merve ERDAL	(METU, Dept. Of Mechanical Eng.)	merdal@metu.edu.tr
Abdülkadir ERDEN	(Atılım Univ., Dept. of Mechatronics Eng.)	erden@metu.edu.tr
S. Engin KILIÇ	(METU, Dept. Of Mechanical Eng.)	engink@metu.edu.tr
E. İlhan KONUKSEVEN	(METU, Dept. Of Mechanical Eng.)	konuk@metu.edu.tr
Orhan YILDIRIM	(METU, Dept. Of Mechanical Eng.)	orhany@metu.edu.tr

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

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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

When a group of faculty from the Mechanical Engineering Department of Middle East Technical University (METU) founded MATIMAREN, the *Machine Design and Production Research Center*, in 1979; they had the ambition of constituting a synergy to develop a collective and cooperative research capacity in order to generate knowledge and technological know-how for handling the challenging problems of the industry. Within a very short time, MATIMAREN became successful in completing numerous projects involving the industry and soon became well-known throughout the country. As MATIMAREN became more and more successful, the founders felt socially responsible to spread this movement, to disseminate and share their experiences and the accumulated know-how with the academia and the industry, by means of organizing a national conference every two years. Thus was formed the beginnings of the "International Conference on Machine Design and Production" (or UMTIK - ***U****luslararası* ***M****akina* ***T****asarım ve* ***İ****malat* ***K****ongresi* in Turkish), which has been an international conference since 1994.

As the organizers of UMTIK 2010, we are happy to see that the international interest to the Conference has consistently increased over the years. The Conference has provided a real platform for the academicians and the industrialists to share their ideas and their knowledge. This year, the first day events on the 29th of June are focused on the importance of the "systematic approach" to industrial problems or in developing partnerships on innovative business ideas. As part of the opening day events, Prof. Yusuf Altintaş of University of British Columbia (Canada), will give a seminar geared towards the industry, in which he will discuss, from the basic principles to the most elaborate ones, the systematic approaches to modeling high performance machines and machining processes, which are becoming more and more commonly used in manufacturing of precision parts. Also on the opening day, Dr. Christoph Meier of Platinn (Switzerland) will conduct the industrial workshop entitled "From Business Innovation Opportunities to Win-Win Co-operations". The workshop participants will be actively involved during the tutorials in learning how they can establish successful cooperations with other companies and academia on innovative ideas, through a number of real case studies. With such tools, the

Conference is expected to initiate quite a few partnerships between the academia and the industry.

Besides the first day program; there will be 73 papers to be presented during the following days of the conference. Six of those papers will be presented by the keynote speakers, whereas 19 papers will be presented in 6 special sessions. The keynote speeches and the special sessions are all held in English. Out of the remaining 48 papers, 15 are in Turkish and the rest are in English. The variety among the session topics is expected to attract both academic and industrial participants.

In acknowledgment, we thank the President, Prof. Turgut Tümer, the Secretary General Prof. Erdal Onurhan and the rest of the academic and the administrative staff of the METU Northern Cyprus Campus, for providing us with the needed facilities and graciously assisting us in solving the problems that arose during the preparations. We would like to thank the keynote speakers, the authors and all participants for their valuable contributions. Bahram Lotfi Sadigh, Ph.D. candidate in METU, is gratefully acknowledged for the tremendous time and effort he spent in every aspect of the organization of the conference. Mehdi Saadati, who designed the graphics in all documentation for the Conference (including the conference logo and the poster graphics), is also acknowledged.

Last, but not the least, we would also like to thank our sponsors, the International Program Committee Members, the referees, our conference secretariat, ORIGIN, and all those who contributed to the success of UMTIK 2010.

We wish all the participants a highly memorable time during their stay at our METU Campus in Northern Cyprus.

The Organizing Committee

UMTIK 2010, 29 June-2 July 2010

METU-Northern Cyprus Campus, Kalkanli, Guzelyurt, TRNC

JUNE 30, 2010 – WEDNESDAY			
8:30-9:30	REGISTRATION		
9:30-10:00	OPENING SESSION		
10:00-10:45	(I1) Grand Hall Keynote Speaker: Prof. Dr. Cristoph Meier "Business Innovation through Collaborative Creation"		
10:45-11:00	COFFEE BREAK		
11:00-12:30	(I2) Grand Hall Sponsors Session		
12:30-13:30	LUNCH		
13:30-14:15	(I3) Grand Hall Keynote Speaker: Prof. Dr. Yusuf Altintas "Virtual Computer Numerical Control System"		
14:15-15:45	Hall 1	Hall 2	
	A1 Modeling of machine tools and machining: E29,E30,E36, E06	B1 Special Session: Liquid Composite Molding Processes (1) ME1, ME2, ME3	
15:45-16:00	COFFEE BREAK		
16:00-18:15	Hall 1	Hall 2	Hall 3
	A2 Processing and properties of Ti Alloys: E21, E24,E35	B2 Special Session: Liquid Composite Molding Processes (2) ME4, ME5, ME6	C2 Special Session: Probabilistic Design of Mechanical Systems EA1, EA2, EA3, EA4
19:30-22:00	COCKTAIL		

JULY 1, 2010 - THURSDAY			
8:30-9:15	(I4) Grand Hall **Keynote Speaker:** Prof. Dr. Leo J De Vin "Virtual Manufacturing Practice and Advanced Applications"		
9:15-10:45	**Hall 1**	**Hall 2**	**Hall 3**
	A3 **Special Session: Micro Manufacturing** YK1, YK2, YK3	**B3** **Materials Behavior:** E03, E08	**C3** **Manufacturing Systems (1):** E15,E38,E25
10:45-11:00	COFFEE BREAK		
11:00-11:45	(I5) Grand Hall **Keynote Speaker:** Prof. Dr. Lihui Wang "Challenges of Adaptive and Collaborative Manufacturing in the 21st Century"		
11:45-13:15	**Hall 1**	**Hall 2**	**Hall 3**
	A4 **Manufacturing Systems (2):** E18,E27	**B4** **Malzeme ve Proses:** T03, T12,T21	**C4** **Talaşlı İmalat:** T02, T06, T11,T05
13:15-14:15	LUNCH		
14:15-15:30	**Hall 1**	**Hall 2**	**Hall 3**
	A5 **Conceptual Design:** E28,E32,E34	**B5** **Robots:** E07,E10	**C5** **Tasarım uygulamaları (1):** T04, T08, T14
15:30-15:45	COFFEE BREAK		
15:45-17:15	**Hall 1**	**Hall 2**	**Hall 3**
	A6 **Engineering Design:** E05, E12, E33	**B6** **Material Characteristics:** E01,E02	**C6** **Tasarım Uygulamaları (2):** T07,T13,T19,T20
19:30	CONFERENCE DINNER		

JULY 2,2010,FRIDAY			
8:30-9:15	(I6) Grand Hall **Keynote Speaker:** Prof. Dr. B. Serpil Acar "Product Design through Computational Modelling and Simulations"		
9:15-10:45	**Hall 1**	**Hall 2**	**Hall 3**
	A7 **Special Session: Design for Automotive Safety (1)** SA1, SA2, SA3	**B7** **Internal Combustion Engine Applications:** E23,E37, E39	**C7** **Tasarım Uygulamaları (3):** T09, T10
10:45-11:00	COFFEE BREAK		
11:00-11:45	(I7) Grand Hall **Keynote Speaker:** Prof. Dr. –Ing. H. Exner "Laser Micro Sintering – State of the Art and Perspectives"		
11:45-13:15	**Hall 1**	**Hall 2**	
	A8 **Special Session: Design for Automotive Safety (2)** SA4, SA5, SA6	**B8** **Non Traditional Processes:** E04,E09	

June 30, 2010 (Wednesday)

(I 1)	**Keynote Lecture**	**Grand Hall**	**10:00–10:45**

***Chaired by**: Mr. Hürriyet EĞİLMEZ*

"Business Innovation through Collaborative Creation"
Keynote Speaker: Professor Dr. Cristoph MEIER

(I2)	**Sponsors Session**	**Grand Hall**	**11:00–12:30**

***Chaired by:** Professor Dr. Ali ÜNÜVAR*

(I 3)	**Keynote Lecture**	**Grand Hall**	**13:30–14:15**

***Chaired by:** Professor Dr. Bilgin KAFTANOĞLU*

"VIRTUAL COMPUTER NUMERICAL CONTROL SYSTEM"
Keynote Speaker: Professor Dr. Yusuf ALTINTAŞ

(A1)	**Modeling of Machine Tools and Machining**	**HALL 1**	**14:15–15:45**

***Chaired by:** Professor Dr. Oktay ALNIAK*

EFFECT OF IMPACT VELOCITY AND ANGLE ON THE DEFORMATION BEHAVIOR OF MICRON SCALE PARTICLES (E06)
Baran YILDIRIM, Sinan MÜFTÜ, Andrew GOULDSTONE

EFFECTS OF CUBIC NONLINEARITY OF BEARING ON FRF OF SPINDLE SYSTEM AND ON STABILITY OF CUTTING PROCESS (E29)
Zekai Murat KILIÇ, H. Nevzat ÖZGÜVEN, Yusuf ALTINTAŞ

PROCESS SIMULATION FOR 5-AXIS MACHINING USING GENERALIZED MILLING TOOL GEOMETRIES (E30)
Ömer M. ÖZKIRIMLI, Erhan BUDAK

A GENERIC POSTPROCESSOR FOR TABLE-TILTING TYPE FIVE-AXIS MACHINE TOOL WITH VARIABLE FEEDRATE (E36)
Yaman BOZ, Ismail LAZOGLU

June 30, 2010 (Wednesday)

(B1)	Special Session: Advanced Composites: Processing and Applications (1)	HALL 2	14:15–15:45

Organized and chaired by: *Dr. Merve ERDAL and Dr. Murat SÖZER*

CONTROL AND OPTIMIZATION OF CURE CYCLE FOR THICK-SECTIONED THERMOSET COMPOSITES MANUFACTURING (ACPA1)
Ozer UNLUHISARCIKLI, Nuri ERSOY

COMPOSITE ARMOR FOR MINE PROTECTION OF MILITARY VEHICLES (ACPA2)
Bora BALYA, Fikret ŞENEL, Emel BİLLUR, Levend PARNAS, Metin TANOĞLU

DRILLING CARBON FIBER REINFORCED PLASTICS WITH DIAMOND COATED CARBIDE AND POLYCRYSTALLINE DIAMOND CUTTING TOOLS (ACPA3)
Yiğit KARPAT, Necip CAMUŞCU, Ayhan KILIÇ, Ferhat SONAT, Burak DEĞER, Onur BAHTİYAR

(A2)	Processing and Properties of Ti Alloys	HALL 1	16:00–18:15

Chaired by: *Professor Dr. Yusuf ALTINTAŞ*

TEMPERATURE DEPENDENT FLOW SOFTENING OF TITANIUM ALLOY TI6AL4V: AN INVESTIGATION USING FINITE ELEMENT MODELING OF MACHINING (E021)
Yiğit KARPAT

EFFECT OF PUNCH NOSE RADII IN THE HYDROFORMING OF TITANIUM ALLOY Ti-6Al-4V (E24)
Shahram ABBASNEJAD DIZAJI, Hassan NEZAMI, Faramarz DJAVANROODI, Rahim KHUSHEHMEHR

THERMAL AND MECHANICAL ANALYSIS OF MACHINING TI6AL4V AND INCONEL 718 (E035)
Onur DEMİR, Coşkun İSLAM, İsmail LAZOĞLU, Ertem AYGİN, Cem SİPAHİOĞLU, Ozgür ILGAZ, Onur ATEŞ

July 30, 2010 (Wednesday)

(B2) Special Session: HALL 2 16:00–18:15
Advanced Composites: Processing and Applications (2)

Organized and chaired by: *Dr. Merve ERDAL and Dr. Murat SÖZER*

SENSOR SYSTEMS USED IN THE RESIN TRANSFER MOLDING AND VACUUM INFUSION PROCESSES TO MONITOR MOLD FILLING AND RESIN CURE (ACPA4)
E. Murat SÖZER, Bekir YENİLMEZ

MECHANICAL CHARACTERIZATION OF CARBON REINFORCED COMPOSITES PRODUCED BY RESIN INFUSION TECHNIQUES (ACPA5)
Onur MİSKBAY, Levent PARNAS, Fikret ŞENEL, Bora BALYA

COMPRESSION RESIN TRANSFER MOLDING OF PARTICLE-FILLED CONTINUOUS FIBER REINFORCED COMPOSITES (ACPA6)
Hatice Sinem ŞAŞ, Gönenç BAŞOL, Merve ERDAL

(C2) Special Session: HALL 3 16:00–18:15
Probabilistic Design of Mechanical Systems

Organized and chaired by: *Dr. Erdem ACAR*

ROBUST EXPERIMENTAL DESIGN OF MACHINING PROCESS OF MARTENSITIC STAINLESS STEEL WITH A CERAMIC TOOL (EA1)
Erdem ACAR, Necip ÇAMUŞCU, Ali Osman ER, Ersan ARSLAN

EFFICIENT RELIABILITY ASSESSMENT OF HIGHLY SAFE MECHANICAL SYSTEMS THROUGH GUIDED TAIL MODELING (EA2)
Erdem ACAR

REVIEW OF APPROXIMATION METHODS FOR STRUCTURAL RELIABILITY ANALYSIS (EA3)
Irfan KAYMAZ

IMPLEMENTATION OF A RELIABILITY BASED DESIGN ALGORITHM FOR HIGH-FIDELITY STRUCTURAL OPTIMIZATION OF AN AIRCRAFT WING (E14)
Melike NİKBAY, Semra BAYAT, Necati FAKKUSOĞLU, Muhammet Nasif KURU

July 1, 2010 (Thursday)

(I 4)	Keynote Lecture	Grand Hall	8:30–9:15

Chaired by: *Professor Dr. EXENER*

"VIRTUAL MANUFACTURING PRACTICE AND ADVANCED APPLICATIONS"
Keynote Speaker: Professor Dr. Leo J De VIN

(A 3)	Special Session: Micro Manufacturing	HALL 1	9:15- 10:45

Organized and chaired by: *Dr. Yiğit KARPAT and Dr. Sinan FİLİZ*

A MODEL FOR BENDING, TORSIONAL AND AXIAL VIBRATIONS OF MICRO-DRILLS (KF1)
Sinan FİLİZ, O. Burak ÖZDOGANLAR

DEBRIS ACCUMULATION PHENOMENA IN MICRO ELECTRIC DISCHARGE MACHINING OF MICRO HOLES (KF2)
Bülent EKMEKCİ, Atakan SAYAR, Tahsin Tecelli ÖPÖZ, Abdulkadir ERDEN

TECHNOLOGICAL ADVANCES IN MICRO-MANUFACTURING (KF3)
Emrullah KORKMAZ, Yiğit KARPAT, Sinan FİLİZ

(B3)	Materials Behavior	HALL 2	9:15- 10:45

Chaired by: *Professor Dr. Ali KALKANLI*

EFFECT OF Zr ADDITION ON THE MECHANICAL BEHAVIOR, DUCTILITY AND WEAR RESISTANCE OF ALUMINUM GRAIN REFINED BY TITANIUM PLUS BORON (E03)
Adnan I.O.ZAID, Safwan M.A. AL QAWABAH

INVESTIGATION OF BURR HEIGHT IN FACE MILLING OF A284 STEEL (E08)
Erol KILIÇKAP, Mesut HÜSEYİNOĞLU, Orhan ÇAKIR

July 1, 2010 (Thursday)

(C3) Manufacturing Systems (1)	HALL 3	9:15- 10:45

Chaired by: *Professor Dr. Yoshiyuki MATSUKA*

EXAMINING THE EFFECT OF LOT SIZES AND SETUP TIMES BY USING SIMULATION (E15)
Oytun ERDEN, Ahmet ÇUBUKCU, Nilgün FESCİOĞLU-ÜNVER

CONSTRUCTION OF PRODUCT DEFINITION DATA FOR DIGITAL MANUFACTURING (E25)
H.EĞİLMEZ, C.CANGELİR

UNCERTAINTY ANALYSIS METHODS FOR THE MEASUREMENTS OF COORDINATE MEASURING MACHINE (E38)
Ahmet SÖZAK, E. İlhan KONUKSEVEN, Melik DÖLEN

(I 5) Keynote Lecture	Grand Hall	11:00–11:45

Chaired by: *Professor Dr. Christoph MEIER*

"Challenges of Adaptive and Collaborative Manufacturing in the 21st Century"
Keynote Speaker: Professor Dr. Lihui WANG

(A4) Manufacturing Systems (II)	HALL 1	11:45–13:15

Chaired by: *Dr. Zühal ERDEN*

THE CUTTING EDGE OF RFID TECHNOLOGY AND APPLICATIONS FOR MANUFACTURING SYSTEMS (E18)
Vahid BAGHERPOOR, Majid HASHEMIPOUR, Hamed FARAHANI MANESH

A COLLABRATION FRAMEWORK FOR PRODUCT DATA MANAGEMENT AND EXHANGE BASED ON OPEN STANDARDS AND SOA (E27)
Tahir FİDAN, Özgür ÜNVER, S. Engin KILIÇ

July 1, 2010 (Thursday)

(B4) Malzeme ve Proses	HALL 2	11:45–13:15

Chaired by: *Dr. Necip ÇAMUŞCUOĞLU*

İNELASTİK MALZEMELERDE MARTENSİTİK FAZ DÖNÜŞÜMLERİ (T12)
İstemi B. ÖZSOY, Valery I. LEVITAS

TIG KAYNAĞI İLE BİRLEŞTİRİLMİŞ Al-SiC KOMPOZİT MALZEMELERİN EĞME DAYANIMININ YAPAY SİNİR AĞLARI İLE TAHMİNİ (T21)
Hülya DURMUŞ, Selda AKGÜN KAYRAL, Salim ŞAHİN

(C4) Talaşlı İmalat	HALL 3	11:45–13:15

Chaired by: *Professor Dr. Levent PARNAS*

AA5083 ALAŞIMIN FREZELENMESİNDE YÜZEY KALİTESİNİ ETKİLEYEN FAKTÖRLERİN İSTATİSTİKSEL OLARAK DEĞERLENDİRİLMESİ (T02)
Ahmet Murat PİNAR, Enver ATİK, Uğur ÇAVDAR, A. Faruk PİNAR

FREZELEMEDE TIRLAMA TİTREŞİMLERİ İÇİN SÜREÇ SÖNÜMLEME MODELİ (T06)
Erol TÜRKEŞ

KESME PARAMETRELERİNİN KESME KUVVETLERİNE ETKİSİNİN DENEYSEL ARAŞTIRILMASI (T11)
İlhan ASİLTÜRK, Ali ÜNÜVAR, A.Serhat ERSOYOĞLU

Vidaların Talaş Kaldırma ile İmalinin Yapısal Modeli (T05)
Eldar FETULLAZADE, H.Kemal AKYILDIZ, Haydar LİVATYALI

July 1, 2010 (Thursday)

(A5) Conceptual Design	HALL 1	14:15- 15:30

Chaired by: *Professor Dr. Leo J. DE VIN*

A CONCEPTUAL STUDY ON RESPONSIVE AND RECONFIGURABLE AGENT BASED PRODUCT DEVELOPMENT SYSTEM (E28)
Tahir FİDAN, Özgür ÜNVER, S. Engin KILIÇ

USE OF AHP FOR IMPROVING THE CREATIVITY IN INTRODUCTORY ENGINEERING DESIGN COURSE (E32)
Merve Hande ERGİN

BEHAVIOUR-BASED MODELLING APPROACH FOR THE CONCEPTUAL DESIGN OF MECHATRONIC SYSTEMS USING DISCRETE EVENT SYSTEM SPECIFICATION (DEVS) FORMALISM (E34)
Zühal ERDEN

(B5) Robots	HALL 2	14:15- 15:30

Chaired by: *Professor Dr. Lihui WANG*

DEVELOPMENT OF A FOUR FINGERED ROBOTIC HAND (E07)
Burak DOĞAN, Bilgin KAFTANOĞLU

DEVELOPMENT OF REHABILITATION DEVICE FOR FINGER JOINTS (E10)
Shigeaki HATA, Shigeo HIRANO, Hideo SAKAI

(C5) Tasarım Uygulamaları (I)	HALL 3	14:15- 15:30

Chaired by: *Dr. Orhan ÇAKIR*

DAİRE KESİTLİ YAYLARIN KALIP YAYI OLARAK KULLANILABİLİRLİĞİNİN İNCELENMESİ (T04)
Demet GÖNEN, Ali ORAL, M.Cemal ÇAKIR

KÜÇÜK ÖLÇEKLİ AHŞAP PROFİLİ ÜRETİM SİSTEMİ TASARIMI (T14)
Yiğit TAŞCIOĞLU, Mike R. JACKSON

July 1, 2010 (Thursday)

(A6) Engineering Design	HALL 1	15:45-17:15

***Chaired by**: Professor Dr. Metin AKKÖK*

ROBUST DESIGN METHOD FOR OBJECTIVE CHARACTERISTICS WITH NON-NORMAL DISTRIBUTIONS AND CONTROL FACTORS WITH ADJUSTABLE RANGE (E05)

Takeo KATO, Atsuki WATAI, Satoshi NAKATSUKA, Yoshiki UJIIE, Yoshiyuki MATSUOKA

CONCEPT OF KANSEI AND THINKING IN DESIGN THEORY (E12)

Ryo IWATA, Shigeo HIRANO

TOWARDS DEVELOPMENT OF A NEW BIOMIMETIC/BIOINSPIRED DESIGN METHODOLOGY (E33)

Aylin KONEZ EROĞLU, Zühal ERDEN, Abdulkadir ERDEN

(B6) Material Characteristics	HALL 2	15:45-17:15

***Chaired by:** Dr. Yiğit TAŞCIOĞLU*

EFFECT OF ADDITION OF TANTALUM (Ta) ON THE MECHANICAL BEHAVIOR ON THE FATIGUE LIFE OF THE ZINC-ALLUMINUM ALLOY (ZA5) (E01)

Adnan I.O. ZAID, Du'a O. R. WERAIKAT

EFFECT OF ZIRCONIUM ADDITION ON CHEMICAL CORROSION RESISTANCE OF ALUMINIUM GRAINS REFINED BY TITANIUM IN ACIDIC AND ALKALINE SOLUTIONS (E02)

Adnan I.O. ZAID, Nader A. B. AL THEEB

July 1, 2010 (Thursday)

(C6) Tasarım Uygulamaları (II)	**HALL 3**	**15:45-17:15**

Chaired by: *Professor Dr. Ali ORAL*

ON YILINI TAMAMLAMIŞ LPG TANKLARININ HASAR ANALİZİ (T07)
Fuat KARTAL, Arslan KAPTAN, Yasin KİŞİOĞLU

AISI 304 Paslanmaz Çeliklerin İşlenebilirliğinin Yapay Sinir Ağları Metodu ile Modellenmesi (T13)
Murat OK, Ali ÜNÜVAR, Ali Serhat ERSOYOĞLU

YÜKSEK BASINÇLI KOMPOZİT HİDROJEN TÜPLERİNİN ÜRETİMİNİN İNCELENMESİ (T19)
Oktay ALNIAK, Ahmet OĞUR, Mustafa ERTÜRK, Çetin KARAKAYA

Borlanmiş AISI 4140 Çeliğinde Borür Tabaka Kalınlığının Korozyon Dayanımına Etkisinin Yapay Sinir Ağları ile Tahmini (T20)
Salim ŞAHİN, Hülya KAÇAR, Filiz TAŞTAN

July 2, 2010 (Friday)

(I 6)	**Keynote Lecture**	**Grand Hall**	**8:30–9:15**

Chaired by: *Professor Dr. László DUDÁS*

"Product Design through Computational Modeling and Simulations"
Keynote Speaker: Professor Dr. B. Serpil ACAR

(A7)	**Special Session: Design for Automotive Safety (I)**	**HALL 1**	**9:15-10:45**

Organized and chaired by: *Professor Dr. B. Serpil ACAR*

DESIGN AND MANUFACTURING OF A WHIPLASH-MITIGATING CAR-SEAT DEMONSTRATOR (DAS1)
S. HIMMETOGLU, M. ACAR

DESIGN SPECIFICATIONS FOR ANTHROPOMORPHIC TEST DEVICES REPRESENTING AGEING MALE OCCUPANTS (DAS2)
B. Serpil ACAR, Jiling FENG, Volkan ESAT

DESIGN OF SMART SEATS FOR OCCUPANT PROTECTION (DAS3)
M. ACAR

(B7)	**ICE Applications**	**HALL 2**	**9:15-10:45**

Chaired by: *Professor Dr. Adnan I. O. ZAID*

VARIATION OF ENGINE PERFORMANCE AND EMISSIONS USING ETHANOL BLENDS (E23)
Abdullah ABUHABAYA, John FIELDHOUSE

EXPERIMENTAL INVESTIGATION OF USE OF CANOLA OIL AS A DIESEL FUEL (E37)
Demir BAYKA, Ali ÖZDEMİR

CASTING PARAMETERS AND ASSESSMENT OF COMPACTED GRAPHITE CAST IRON DIESEL ENGINE BLOCKS FOR IMPROVED EFFICIENCY (E39)
Ali KALKANLI, Anıl ALKAN, Sema BAHŞİ, Cemal GÜVEN

July 2, 2010 (Friday)

(C7) Tasarım Uygulamaları (III)	**HALL 3**	**9:15-10:45**

Chaired by: *Mr. Fikret ŞENEL*

BİR ÇİFT SOLENOİDLİ DOĞRUSAL TAHRİK SİSTEMİNİN KONUM ANALİZİ, KONTROL TASARIMI VE DENENMESİ (T09)
İlhami YİĞİT

500 TONLUK DEFORMASYON HIZI KONTROLLÜ ELEKTROHİDROLİK TAHRİKLİ BİR BETON BASMA DENEYİ MAKİNASININ TASARIMI (T10)
İlhami YİĞİT

(I 7) Keynote Lecture	**Grand Hall**	**11:00–11:45**

Chaired by: *Professor Dr. Memiş ACAR*

"Laser Micro- Sintering- State of the Art"
Keynote Speaker: Professor Dr. –Ing H.EXNER

(A8) Special Session: Design for Automotive Safety (II)	**HALL1**	**11:45–13:15**

Organized and chaired by: *Professor Dr. B. Serpil ACAR*

A NOVEL APPROACH TO IN-CAR ROAD SIGN RECOGNITION (DAS4)
U. ZAKIR, I. ZAFAR, E.A.EDIRISINGHE

A STATISTICAL ANALYSIS OF VISUAL DETECTION FAILURES FOR ACTIVE SAFETY FUNCTION EVALUATION (DAS5)
Deniz ATALAR, Pete THOMAS, Julian HILL

AUTOMOTIVE SAFETY DESIGN IN CONJUNCTION WITH ATD DEVELOPMENT (DAS6)
Moustafa MOUSTAFA, B. Serpil ACAR

(B8) Novel Methods	**HALL 2**	**11:45–13:15**

Chaired by: *Dr. Özgür ÜNVER*

GEAR INVESTIGATIONS BASED ON SURFACE CONSTRUCTOR KINEMATICAL MODELLING AND SIMULATION SOFTWARE (E04)
László DUDÁS

LASER-ASSISTED BENDING: A TOOL FOR BRITTLE MATERIALS (E09)
F. BAMMER, T. SCHUMI, G. HUMENBERGER, D. SCHUÖCKER

KEYNOTE PAPERS

NO	TITLE	AUTHOR
I01	**Business Innovation through Collaborative Creation**	**Christoph MEIER**
I03	**Virtual Computer Numerical Control System**	**Yusuf ALTINTAŞ**
I04	**Virtual Manufacturing Practice and Advanced Applications**	**Leo J De VIN**
I05	**Challenges of Adaptive and Collaborative Manufacturing in the 21st Century**	**Lihui WANG**
I06	**Product Design through Computational Modelling and Simulations**	**B. Serpil ACAR**
I07	**Laser Micro Sintering – State of the Art and Perspectives**	**H. EXNER**

About The Speaker

Dr. Cristoph Meier

Dr. CHRISTOPH MEIER was born on 23rd July 1953 in Switzerland. His mother language is German and he fluently writes and speaks French and English. He speaks Italian as well. He received his Diploma of Economist and his Ph.D. from Economics Science, University of Freiburg in 1979 and in 1983, respectively. He is the founder and currently the managing director of the CCSO. In May 2009 the CCSO Network changed its name into Platinn. Platinn (**www.platinn.ch**) is a network organisation for business innovation support to start-up companies and SMEs. Since 1991, innovation projects with more than 1000 companies have been implemented. Main geographic areas of activities are the six cantons of western Switzerland.

He is a member of the SME Advisory Group for the 7th FP since 2009 and of the Swiss Federal CTI Management Board since 2008. He works as the managing director of Inter- Regional Secretariat of Intelligent Manufacturing Systems (IMS -**www.ims.org**.) since 2008 and as the Chairman of the Swiss Federal Knowledge and Technology Transfer (KTT) Programme advisory group since 2006. KTT initiative is supported both by the State Secretariat for Education and Research (SER) and the Innovation Promotion Agency (CTI). Main purpose is to strengthen pull-industry driven transfer activities with academia. The national KTT programme constitutes a key element of many regional and cantonal innovation policies.

He has been doing SME coaching since 1993 as a coach specialized in:

- Business and corporate strategy planning,
- Corporate development (organisation, resources),
- Network management and strategic consortia building,

He leads about 70 workshops per year, mainly in technology based SMEs and start-up companies within the Geographic areas: Switzerland and occasionally in other countries like Cyprus, Italy, and Lithuania. He is also been carrying out special mandates for strategy planning sessions for public organisations in the area of «technology and innovation».

Dr. MEIER was the project coordinator of Regional Innovation Strategy Western Switzerland (RIS-WS) from 2005 to 2008. He was the co-initiator of the project and exploitation partner of smE-MPOWER between 2005-2007. He was also the board member of the CTI Start-up group between 2001-2007.

Business Innovation through Collaborative Creation

With regard to the main factors hampering innovation activities of SMEs, the most pertinent barriers identified by enterprises are lack of access to financing, unacceptable cost of innovation and lack of incentives facilitating co-operation between actors.
“Business Innovation through Collaborative Creation” is at the political heart of many industrialized economies. However, on the company level, there are barriers to establish winning co-operations. Despite the high potential benefit for SMEs and start-up companies, they are facing problems to identify their business innovation opportunities, to design strategic partnerships and to define winning project consortia.
Establishing partnerships within an open innovation environment is the emerging challenge for management. A practical and proven guide over the three main stages of the co-operation building process is provided by the international smE-MPOWER community. Experiences and examples from Switzerland will be presented.

About The Speaker

Professor Dr. Yusuf Altıntaş

Yusuf Altıntaş is a Professor at the University of British Columbia in Canada since 1986. He has manufacturing engineering experience as a machine tool engineer, process planner and CAM engineer. He conducts research in metal cutting mechanics, machine tool vibrations, machine tool control, and virtual high performance machining. He teaches senior undergraduate and graduate level computer control of machines and machine tool vibrations. He directs a fully equipped research laboratory with various machine tools and measurement instrumentation.

Dr. Altintas published over one hundred and ten refereed journal articles, and a textbook entitled “Manufacturing Automation: Principles of metal Cutting Mechanics, Machine Tool Vibrations and CNC Design”. His journal articles received over two thousand five hundred external citations. His laboratory developed Advanced Machining process Simulation Software (CUTPRO) and Virtual CNC System Software Tool Boxes. CUTPRO is used by over one hundred and thirty leading aerospace, automotive, cutting tool, machine tool, spindle, die and mold manufacturing companies as well as leading research centers worldwide.

Dr. Altintas has been a holder of NSERC - Pratt & Whitney Canada Industrial Research, and Fellow of ASME, CIRP, SME, CAE, AvH and Pratt & Whitney Canada. He has received several research awards and holds an Honorary Doctorate degree from Stuttgart University. He is the principal investigator for Canada wide Strategic Project “NSERC Canadian Network for Research and Innovation in Machining Technology(CANRIMT)”. He is the associate editor of several international manufacturing journals.

Virtual Computer Numerical Control System

This paper presents a comprehensive virtual CNC system for CNC machine tools. Ball screw and linear drives, feedback sensors, control laws, trajectory generation and interpolation algorithms, and multi-axis kinematic configurations are stored as modules in MATLAB library. The Virtual CNC (VCNC) has a modular architecture, allowing design of multi-axis real CNC systems from standard library functions.

The designer can start with the selection of ball screw, nut, bearings and continue with motors, amplifier, sensors, trajectory generation and control laws from the library. The system automatically configures a full CNC system up to 5 axis, and predicts the performance of the CNC system through control synthesis as well as simulating the machining of a part using CL (Cutter Location) tool path. Particular emphasis is also placed in teaching control and CNC system design in senior undergraduate and graduate level courses.

About The Speaker

Professor Dr. Leo J De Vin

Leo J De Vin is a Professor in Automation Engineering at the University of Skövde, Sweden. He is the founder of the Virtual Systems Research Centre and one of the co-founders of the Information Fusion Research Program at the university. He is also co-founder of two national industrial graduate schools that have a variety of academic and industrial partners and receive substantial funding from the Knowledge Foundation. He also initiated an industrial Post-Doc program. He received his MSc in Mechanical Engineering in 1989 and his PhD in Production Engineering in 1994 from the University of Twente, The Netherlands. After a Post-Doc position in Computer-Integrated Manufacturing at the University of Ulster at Jordanstown, Northern Ireland, he joined the University of Skövde as a Senior Lecturer in Integrated Product Development in 1997. In 2001, he became a Full Professor in Automation Engineering with substantial direct funding from Volvo. He is a member of a.o. the EPSRC Peer Review College in the UK, the Society of Manufacturing Engineers (SME) in the U.S., the Mechatronics Forum Committee in the UK, and the Presidium of the Swedish Production Academy.

Professor De Vin's initial research interests included feature-based computer aided process planning for sheet metal components, concurrent engineering, simulation of sheet forming processes, and tolerance reasoning for brake forming. He was General Chair of the International Conference on Flexible Automation and Intelligent Automation FAIM 2008, and will be General Chair for Mechatronics 2014. Current research interests include Information Fusion, Human Aspects in Manufacturing, Virtual Manufacturing, and Sustainable Manufacturing. He also is an Adjunct Professor in Computer Science at Örebro University, Sweden.

Virtual Manufacturing Practice and Advanced Applications

Virtual Manufacturing (VM) is a collective name for a number of production simulation tools such as discrete event simulation (DES) and computer aided robotics (CAR). Examples of application areas include production flow simulation, bottleneck analysis, geometric analysis and off-line robot programming. Other VM tools include ergonomic simulation for workplace design & analysis.

The keynote presentation discusses best practice for VM as well as VM pitfalls. VM can be used for several purposes, for instance to generate new knowledge about a System of Interest (SoI) or for training purposes. In the first case, the most usual are decision support and what-if analysis. In the second case, a model of the SoI can be used for serious gaming or to transfer knowledge from a subject matter specialist to the contextual user. However, the first purpose, generating knowledge for decision support or what-if analysis is the most common. In a simulation project, it is important to distinguish between different roles such as problem owner, simulation expert, and subject matter specialist. Likewise, a simulation project has different phases such as definition of problem and goal, and verification, validation & accreditation/acceptance. Both novel and experienced users can benefit from best practice guidelines.

Information Fusion (IF) entails tools and techniques that synergistically combine information and data from a variety of sources such as databases, sensors, simulations and humans. One of many possible purposes of IF is to provide improved decision support in such a way that decisions are better, more robust, or made faster. In manufacturing, IF applications are often to a large extent based on VM, for instance VM in combination with web-based solutions for monitoring & diagnostics, or VM in combination with intelligent data analysis for process control.

Since VM allows for performing what-if analysis, it can be used for decision support for optimal design and/or operation of manufacturing systems. However, simulation typically is an evaluative tool. In other words, it can, for a proposed solution, calculate an outcome, either with or without taking into account stochastic variations. However, the generation of solutions, typically through Design of Experiments (DoE) and subsequently entering them, typically is a tedious task requiring specialist knowledge that the contextual user may not possess. For this kind of application, evaluative simulation tools can be combined with generative tools such as Genetic Algorithms. This area is known as Simulation-Based Optimization (SBO).

A combination of VM-based IF and SBO can be used in the area of multi-objective optimization, in particular for situations in which environmental and economical sustainability have to be combined with delivery accuracy. IF can be used for low-level data-mining, knowledge elicitation, situation awareness and impact analysis. SBO can provide pareto-optimal solutions for a number of use-case scenarios.

About The Speaker

Professor Dr. Lihui Wang

Lihui Wang is a professor in virtual manufacturing of Virtual Systems Research Centre, University of Skövde, Sweden. He received his PhD and MS in Mechanical Engineering from Kobe University (Japan) in 1993 and 1990, respectively, and BS in Machine Design (China) in 1982. He was an Assistant Professor of Kobe University and Toyohashi University of Technology (Japan) prior to joining National Research Council of Canada (NRC) in 1998, where he was a Senior Research Scientist before moving to Sweden in 2008. His research interests are presently focused on collaborative design, virtual manufacturing, distributed manufacturing production planning, web-based real-time monitoring and control, and intelligent and adaptive manufacturing systems. His recent work has won a Best Paper Award at FAIM 2002 (International Conference on Flexible Automation and Intelligent Manufacturing) in Germany, a Best Poster Award at IFIP 2003 (IFIP Conference on Virtual Enterprises) in Switzerland, and an Outstanding Paper Award Finalist at NAMRC 2008 (North American Manufacturing Research Conference) in Mexico. He is also an eight-time winner of NRC Institute Awards on Excellence and Leadership in R&D, Multidisciplinary Collaborative Research, Global Reach, and Outstanding People.

Professor Wang has published eight edited books/proceedings and seven journal special issues. He has authored or co-authored in excess of 180 book chapters, archival journal papers, and peer-reviewed conference articles in the above research areas. In addition to the research work, he is actively engaged in various committee and community activities. He was the Conference Chair of FAIM 2004, a member of Grant Selection Committee (GSC-20 for Industrial Engineering) of Natural Sciences and Engineering Research Council of Canada (2004-2007), and a member of Scientific Committee of North American Manufacturing Research Institution (NAMRI) of Society of Manufacturing Engineers (SME) since 2004. Currently, he is the Editor-in-Chief of International Journal of Manufacturing Research, Editor of Robotics and Computer Integrated Manufacturing, Editor ofJournal of Intelligent Manufacturing, and an Editorial Board Member of other five international journals. He is also a member of Board of Directors of NAMRI/SME, Chair of Manufacturing Systems Technical Committee of American Society of Mechanical Engineers, an Adjunct Professor of University of Western Ontario and a registered Professional Engineer in Canada.

Challenges of Adaptive and Collaborative Manufacturing in the 21st Century

Recently, adaptive and collaborative manufacturing has emerged as the norm of manufacturing in distributed environment under uncertainty. This is largely due to the global business decentralisation and manufacturing outsourcing. To stay competitive in the dynamic global market, companies with distributed factories or divisions are demanding a new way of effective collaborations among themselves and even between their suppliers and outsourced service providers. Among many other factors, flexibility, timeliness and adaptability are identified as the major characteristics to bring dynamism to collaborative manufacturing. The dynamic environment requires an adaptive system architecture that enables distributed planning, dynamic scheduling, real-time monitoring, and remote control. It should be responsive to both varying collaboration needs and unpredictable changes of distributed production capacity and functionality. In response to the requirements and to coordinate the dynamic activities in collaborative manufacturing, a new approach of distributed and web-based planning and control system is introduced to achieve the dynamism in distributed manufacturing environment.

This talk will cover the principle of an underlying Wise-ShopFloor framework, its detailed architecture design, information flow, and a proof-of-concept prototype implementation enabled by Web and Java technologies. A case study of distributed process planning for web-based rapid machining is carried out to demonstrate the effectiveness and to validate the approach toward web-based collaborations in distributed environment.

About The Speaker

Professor B. Serpil Acar

Dr. B Serpil Acar was born in Balikesir, Turkey. She received BS and MS degrees in Mathematics from the Middle East Technical University (METU). After completing her PhD in the Mathematics Department at Loughborough University, UK she worked as in Manufacturing Engineering, Applied Computing and Mathematics, Engineering Design Departments before moving Department of Computer Science/ Research School of Informatics at Loughborough University. Her current research interests include occupant safety, engineering design for women, mathematical modelling of human spine and system design processes. She is the founder of the 'Biomechanics and Injury Prevention' multidisciplinary research group at Loughborough. She works in close collaboration with engineering departments as well as clinical and academic members of the Medical Schools and automotive industry. Dr Acar is the principal investigator of many major Engineering and Physical Sciences Research Council funded projects investigating occupant safety.

Product Design through Computational Modelling and Simulations

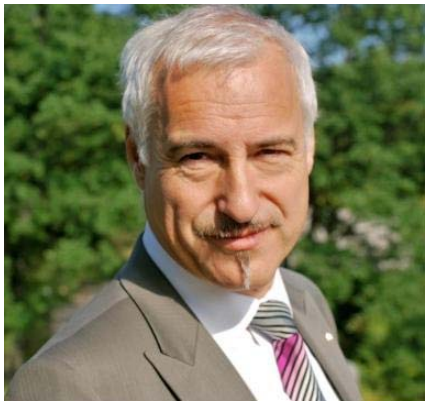
Road Traffic Accidents are the leading cause of severe injuries and accidental death worldwide. The number of fatalities and injury severities are even greater in developing countries. Three-point seatbelts save lives and reduce the injury severities in case of the accidents. There is a need for educating people to wear their seatbelts and wear them correctly. There are also groups of people who have difficulties to wear the seatbelts correctly. Pregnant women are perfect examples of this group of people and present a challenge for automobile manufacturers.

A series of research projects are undertaken at Loughborough University to improve the safety of pregnant occupants. Engineering and Physical Sciences Research Council of the UK have sponsored these research projects. The research started by measurements of pregnant occupants. Then the most advanced computational model of pregnant woman 'Expecting' is developed. This is the only pregnant occupant model which incorporates a multibody model of a fetus in an FE uterus model. 'Expecting' is used in simulations of variety of conditions and crashes. That helped understanding possible improvements in safety not only for pregnant occupants but for all occupants. Guidelines are developed and products based on the research, modelling and simulations are designed.

In this presentation, preparations for the correct representations in modelling, the generation of computational occupant models, simulations and analysis of the results are presented. Problem solving, patent search, concept and detailed design and the prototype development stages are explained on a case study. A new, recently patented product to improve safety for occupants, which is designed and manufactured through computational modelling and simulations, is also introduced.

About The Speaker

Professor Dr. - Ing. H. Exner



Professor Exner was born in 1954 in Rathenow (Germany, district Potsdam). He studied at University of Engineering Mittweida in the field of Electronic Technology between 1976 and 1980 leading his degree Graduate Engineering with his diploma topic "Investigations of Laser Induced Borehole Geometries in Semiconductor Materials". He worked as a teaching assistant at the Physics Department of the University of Engineering Mittweida between 1980 and 1984 while he was doing his Ph.D. on "Contributions to Laser Induced Annealing of Ion Implanted Silicon in Liquid Phase". He worked as a Design Engineer both for education and research between 1984 and 1988. He worked as the Engineering Manager for the establishment of the Laser Application Centre (LAZ) at theUniversity of Engineering Mittweida during 1988-1997. He has been nominated tothe Professor for Physical Technology/Laser Applications at the University ofApplied Sciences Mittweida since 1.10.1992. He is the Director of the Laserinstitut Mittelsachsen e.V. since 1.12.1997 and Vice Rector of the University of Applied Sciences Mittweida since 1.03.2006. Looking behind his famous research work in the area of laser technology Professor Dr.- Ing. Horst Exner can refer to over 150 scientific publications and 44 patent registrations. For his research work 6 national and international honours were lent to him. His emphasized fields in research areall kinds of laser material processing (micro and macro) among them laser processing of ceramics and laser micro sintering. Beside his successful scientific work, he has engaged himself intensively for the transfer of laser technology and co-operation with enterprises. Currently, the LaserApplicationCenter contains more than 30 laser machines of most modern design of all wavelengths and all pulse times. The Center offers research and seminal development as well as industrial and business applications.More information is available at: **www.laserinstitut.org**.

Laser MicZro Sintering – State of the Art and Perspectives

Laser micro sintering, a modification of selective laser sintering for the freeform fabrication of micro-parts and first time published in the early 2003 [1], was developed in the University of Applied Sciences Mittweida and has been upgraded continuously. The early development of the laser micro sintering technology was done for metals to produce parts layer by layer with powder particle sizes of lower than 1 µm and a special rake in the shape of a ring. The obtained structures show a resolution of less than 30 µm for structural details, of 20 µm for ligaments and of 10 µm for notches at aspect ratios up to 200 and a minimal roughness Ra of 1.5 µm. Later we also applied powders with grain sizes up to 10 µm with a lower resolution of the generated bodies but also a faster process. Metals like W, Ag, Cu, Mo, different stainless steels and also mixtures between Cu and W and 80Ni20Cr-alloy are used for the described process. With two or more rakes we are able to work with different materials in the same building process simultaneously. In 2005 we have published first results for our further development of the sinter method for the generation of ceramic parts [2]. Today we are able to produce freeform Alumina ceramic parts crack free and high dense (97%) with nearly no shrinking after furnace (lower than 0.7%) without a binder material. The structural resolution of the products is in the range of 40 µm. We also can generate other ceramic parts out of SiOx and SiSiC. The sintering of different material is accomplished through laser radiation in the ns pulse regime. Wavelengths of the employed lasers are in the near infrared or in the visible spectral range. For a while a new powder compressing step was investigated and inserted after each rake cycle. It mainly compacts the fine powder material by compressive forces and additionally homogenizes the powder distribution. So we could overcome some physical limits of the used fine powders which results in not a 100% density of the sintered parts. For the first time it was possible to generate mechanical functional micro parts, which contain free moveable or rotatable sub structures. This paper will present the principle of the process and the state of the art of laser micro sintering, its advances and limitations, views of the products and the newest results of the further development of this technology. The introduced laser micro sintering technology opens up a new dimension for the freeform fabrication of miniature and precise parts with application potentialities in a multitude of engineering fields.

References:

[1] Regenfuss, P.; Hartwig, L.; Klötzer, S; Ebert, R.; H. Exner, H.: Microparts by a Novel Modification of Selective Laser Sintering. Conference Paper; Rapid Prototyping and Manufacturing Conference, May 12– 15, 2003, Chicago (IL), USA

[2] H. Exner (Sp), L. Hartwig, A. Streek, M. Horn, S. Klötzer, R. Ebert, P. Regenfuss:First Results in Laser Micro Sintering of Ceramic Materials; Laserinstitut Mittelsachsen e.V. an der Hochschule Mittweida (Germany), Euromat Prag, 2005

ABSTRACTS

CONTROL AND OPTIMIZATION OF CURE CYCLE FOR THICK-SECTIONED THERMOSET COMPOSITES MANUFACTURING (CFRP1)

Ozer UNLUHISARCIKLI, ozer.unluhisarcikli@boun.edu.tr Bogazici University, 34342, Istanbul
Nuri ERSOY, nuri.ersoy@boun.edu.tr Bogazici University, 34342, Istanbul

ABSTRACT

The objective of this study was to minimize the temperature gradients encountered during the manufacturing of thick-sectioned thermoset composites. Temperature gradients should be minimized because they reduce the quality of the part due to uneven curing. A finite difference simulation was developed based on mathematical models representing the curing phenomenon. A multi-variable optimization method, namely the sequential simplex algorithm was coupled with the simulation to minimize the temperature gradients and the process time simultaneously. An experimental setup with temperature control was built, and experiments were carried out in order to verify the accuracy of the analysis with the experimental results. In the light of the experimental results, the efficiency of the approach was discussed, and potential improvements to the study were proposed.

Keywords: Thick-sectioned composites, Cure cycle optimization

COMPOSITE ARMOR FOR MINE PROTECTION OF MILITARY VEHICLES (CFRP2)

Bora BALYA, *bora.balya@bariselektrik.com.tr* Barış Elektrik Endüstrisi A.Ş., 06750, Ankara
Fikret ŞENEL, *fikret.senel@bariselektrik.com.tr* Barış Elektrik Endüstrisi A.Ş., 06750, Ankara
Emel BİLLUR, *emel.billur@bariselektrik.com.tr* Barış Elektrik Endüstrisi A.Ş., 06750, Ankara
Levend PARNAS, *parnas@metu.edu.tr* Orta Doğu Teknik Üniversitesi, 06531, Ankara
Metin TANOĞLU, *metintanoglu@iytu.edu.tr* İzmir Yüksek Teknoloji Enstitüsü, 35430, İzmir

ABSTRACT

In this paper, the study on add-on armor which is designed to enhance the level of protection of armored vehicles is presented. The introduction part includes general literature on add-on armor. In the second part of the paper, armor materials, design and production techniques, results of ballistic simulations are presented. In the final part, the conclusions are made.

Keywords: Mine, Blast, Composite, Armor, Design, Production, Simulation

DRILLING CARBON FIBER REINFORCED PLASTICS WITH DIAMOND COATED CARBIDE AND POLYCRYSTALLINE DIAMOND CUTTING TOOLS (CFRP3)

Yiğit KARPAT, y*karpat@bilkent.edu.tr* Bilkent University, 06800, Ankara
Necip CAMUŞCU, n*camuscu@etu.edu.tr* TOBB ETU University,06560,Ankara
Ayhan KILIÇ, *akilic@tai.com.tr* Turkish Aerospace Industries Inc., 06980 Ankara
Ferhat SONAT, *fsonat@tai.com.tr* Turkish Aerospace Industries Inc., 06980 Ankara
Burak DEĞER, *bdeger@tai.com.tr* Turkish Aerospace Industries Inc., 06980 Ankara
Onur BAHTİYAR, *obahtiyar@tai.com.tr* Turkish Aerospace Industries Inc., 06980 Ankara

ABSTRACT

Carbon fiber reinforced plastics are widely used in the aerospace industry since they exhibit superior properties such as high strength to weight ratio and low thermal expansion coefficient. Composite part manufacturing is a net shape processing, yet additional machining operations are required to obtain final design requirements. Drilling, the most common machining operation, is the subject of this study. The machining characteristics of carbon fiber composites are quite different than those of metals since they demonstrate inhomogeneous material behavior. Rapid tool wear due to abrasive nature of the carbon fibers and delamination at the entry and exit of the holes are two main problems while drilling carbon fiber composites. It is important for manufacturers to understand machining characteristics of these materials since expensive diamond coated carbide and polycrystalline diamond cutting tools are usually employed. This study uses an experimental approach to examine the drilling of fabric woven and intermediate modulus unidirectional carbon fiber laminates by using diamond coated carbide and polycrystalline diamond cutting tools. Experimental observations on tool wear, cutting forces and delamination while drilling two different types of carbon fiber composites are reported.

Keywords: Machining, Drilling, Carbon fiber reinforced plastics, Diamond coated carbide, Polycrystalline diamond, Tool wear, Delamination

SENSOR SYSTEMS USED IN THE RESIN TRANSFER MOLDING AND VACUUM INFUSION PROCESSES TO MONITOR MOLD FILLING AND RESIN CURE (CFRP4)

E. Murat SÖZER, *msozer@ku.edu.tr* Koc University, Rumelifeneri Yolu, Sariyer 34450, Istanbul, Turkey
Bekir YENİLMEZ, *byenilmez@ku.edu.tr* Koc University, Rumelifeneri Yolu, Sariyer 34450, Istanbul, Turkey

ABSTRACT

Use of thermocouple, voltage (resistive) and dielectric sensor systems were reviewed in the Resin Transfer Molding (RTM) process to monitor resin flow during the mold-filling stage. Their advantages and disadvantages were compared in various case studies along with investigating some of the constraints in the sensor systems. The sensor systems' performance was evaluated based on the time delay between the actual resin arrival to a sensor location and the sensor's "arrival-flag" response; accuracy; cost; durability when typical harsh molding/demolding conditions are considered; and if monitoring of resin cure besides monitoring of resin flow can also be achieved by using the same sensor system. All the sensors were integrated to a LabView DAQ system for on-line control applications. The experimental results were also verified with analytical 1D resin flow based on Darcy Law and numerical solution of conductive heat transfer within the mold walls and convection of the heat in the mold cavity.

Keywords: Resin Transfer Molding (RTM), Vacuum Infusion (VI), Sensor, Monitoring Resin Flow

MECHANICAL CHARACTERIZATION OF CARBON REINFORCED COMPOSITES PRODUCED BY RESIN INFUSION TECHNIQUES (CFRP5)

Onur MİSKBAY, *miskbay@gmail.com,* Barış Elektrik Endüstrisi A.Ş., Esenboğa yolu, 23. km, 06750, Akyurt, Ankara
Prof.Dr. Levend PARNAS, *parnas@metu.edu.tr,* Orta Doğu Teknik Üniversitesi, 06531, Ankara
Fikret ŞENEL, *fikret.senel@bariselektrik.com.tr,* Barış Elektrik Endüstrisi A.Ş., Esenboğa yolu, 23. km, 06750, Akyurt, Ankara
Bora BALYA, *bora.balya@bariselektrik.com.tr,* Barış Elektrik Endüstrisi A.Ş., Esenboğa yolu, 23. km, 06750, Akyurt, Ankara

ABSTRACT

A study is conducted to compare and evaluate Vacuum Bagging (VB) and the most common resin infusion techniques which are Resin Transfer Molding (RTM), Vacuum Assisted RTM (VARTM), Light RTM (LRTM). Material tests including tensile, compression and shear tests are performed in accordance with ASTM standards on carbon-epoxy specimens. Mechanical properties for production techniques are determined and assessed. Experimental results obtained in the study are presented for comparison purposes.

Keywords: Composite, Resin Infusion, Vacuum Bagging, Resin Transfer Molding (RTM), Carbon-Epoxy

COMPRESSION RESIN TRANSFER MOLDING OF PARTICLE-FILLED CONTINUOUS FIBER REINFORCED COMPOSITES (CFRP6)

Hatice Sinem ŞAŞ, *hsas@metu.edu.tr* Middle East Technical University, 06531 Ankara, Turkey
Gönenç BAŞOL, *gbasol@mgeo.aselsan.com.tr* Microelectronics, Guidance and Electro-Optics Division, ASELSAN Inc., Akyurt, 06750 Ankara, Turkey
Merve ERDAL, *merdal@metu.edu.tr* Middle East Technical University, 06531 Ankara, Turkey

ABSTRACT

Compression Resin Transfer Molding (CRTM) is a modification of the Resin Transfer Molding (RTM) process, which is used for manufacturing continuous fiber reinforced composites for structural applications. The potential advantage of CRTM over RTM is the improvement in the wettability of the fibers with the resin and better consolidation of the composite. In addition, CRTM is a candidate process for manufacturing large structural composites. In this study, a model is presented for the impregnation and compression stages of CRTM, by coupling Darcy law with particle filtration kinetics and conservation equations. COMSOL Multiphysics software is used to model the 2-D CRTM and RTM processes. Results are presented for both RTM and CRTM processes and the outcomes of the two processes are compared.

Keywords: liquid molding, structural composites, particle filtration, compression resin transfer molding

DESIGN AND MANUFACTURING OF A WHIPLASH-MITIGATING CAR-SEAT DEMONSTRATOR (DAS1)

S. HIMMETOGLU, *s.himmetoglu@hacettepe.edu.tr,* Hacettepe University, Ankara, Turkey
M. ACAR, *m.acar@lboro.ac.uk* Loughborough University, Loughborough, UK

ABSTRACT

Whiplash is a common neck-injury in road traffic accidents which frequently occurs in rearend crashes. This paper presents design and manufacturing of a conceptual car-seat aimed at reducing whiplash injuries in rear impacts. Computational multi-body models of a generic car seat and a biofidelic 50th-percentile male human model for rear impact are developed to evaluate the effectiveness of the proposed car-seat concepts. A physical model of a selected car-seat concept is built and sled-tested.

Keywords: Whiplash injury; Car-seat design; Rear impact

DESIGN SPECIFICATIONS FOR ANTHROPOMORPHIC TEST DEVICES REPRESENTING AGEING MALE OCCUPANTS (DAS2)

B. Serpil ACAR, B.S.Acar@Lboro.ac.uk, Loughborough University, Leicestershire, LE11 3TU, UK
Jiling FENG, J.Feng@Lboro.ac.uk, Loughborough University, Leicestershire, LE11 3TU, UK
Volkan ESAT, V.Esat@Lboro.ac.uk, Loughborough University, Leicestershire, LE11 3TU, UK

ABSTRACT

Increasing proportion of older drivers in the western countries and accident patterns involving older occupants are serious concerns for automotive safety and injury prevention engineers and researchers. Current research shows that the number of total fatal car crashes has decreased in the last 10 years; however, the rate of fatality per mile driven for ageing occupants is increasing significantly. Anthropomorphic Test Devices (ATDs) - also known as crash test dummies - are widely employed in crash and sled tests. The most commonly used ATDs in frontal crashes are Hybrid III 50th percentile male and to a certain extent Hybrid III 5th percentile female models. This study presents the anthropometric and in-car measurements of ageing male drivers, and investigates if the characteristics of ageing drivers match with those of most commonly used ATDs. Design specifications for future ageing male occupant ATDs are suggested.

Keywords: Ageing drivers, ATD, anthropometrics, crash test dummies

DESIGN OF SMART SEATS FOR OCCUPANT PROTECTION (DAS3)

M. ACAR, *m.acar@lboro.ac.uk* Loughborough University, Loughborough, UK

ABSTRACT

This paper reports two examples of smart occupant protection systems. The first design is a head restraint system designed to reduce whiplash injuries. The head restraint mechanism is combined with sensors and actuators to form an active head restraint, which detects the position of an occupant's head when seated in the car seat and automatically moves the head restraint to an optimum position to reduce the risk of whiplash injuries in the event of a rear impact. The second example is a child restraint system (CRS), which is integrated with the conventional car seat that adjusts itself automatically to the correct position for the size of the child occupant. The working principles of both concept demonstrators that were built and tested are explained. Both head restraint and CRS systems were exhibited at the ESV Collegiate Student Safety Technology Design Competitions, in Washington DC in 2005 and in Lyon in June 2007, respectively, as one of the three finalists representing the European region.

Keywords: Whiplash injury; Head-restraint design; Rear impact, Child restraint system; CRS

A NOVEL APPROACH TO IN-CAR ROAD SIGN RECOGNITION (DAS4)

U. ZAKIR, u.zakir@*lboro.ac.uk* Loughborough University, DIRG, Loughborough, UK
I. ZAFAR, i.zafar@*lboro.ac.uk* Loughborough University, DIRG, Loughborough, UK
E.A.EDIRISINGHE, e.a.edirisinghe@*lboro.ac.uk* Loughborough University, DIRG, Loughborough, UK

ABSTRACT

Real-time in-car road sign detection and recognition systems can provide an additional level of driver assistance leading to improved safety to passengers, road-users and vehicles. Such systems can be used to alert a driver to the presence of a road sign, reducing risks in situations of driver distraction, fatigue and poor-driving conditions. In comparison to GPS based vehicle navigation systems that are currently being used, which depend on maps pre-annotated with road signs, an in-car vision system will provide real-time capability of road sign recognition, enabling accurate performance despite the lack of map coverage and any real-time additions of new road signs. This paper proposes the use of a novel *combined colour model* in the accurate and robust road sign segmentation. It is complemented by a novel approach to road sign recognition which is based on a Local Energy based Shape Histogram (LESH). Experimental results and a detailed analysis to prove the effectiveness of the proposed vision system are provided. An accuracy rate of above 97.5% is recorded.

Keywords: Combined Colour Model, LESH, Road Sign Recognition

A STATISTICAL ANALYSIS OF VISUAL DETECTION FAILURES FOR ACTIVE SAFETY FUNCTION EVALUATION (DAS5)

Deniz ATALAR, *d.atalar@lboro.ac.uk,* Vehicle Safety Research Centre, Loughborough University, Loughborough, LE11 3UZ
Pete THOMAS, *p.d.thomas@lboro.ac.uk,* Vehicle Safety Research Centre, Loughborough University, Loughborough, LE11 3UZ
Julian HILL, *j.r.hill@lboro.ac.uk,* Vehicle Safety Research Centre, Loughborough University, Loughborough, LE11 3UZ

ABSTRACT

The objective of this study is to understand the visual detection failure sequences that result in traffic accidents. An accident causation analysis was used to interpret and group causal factors for 5 distinct detection failure types that caused traffic accidents. Principal component analysis was used to interpret in-depth, on spot, accident causation data. Several scenarios were identified describing combinations of context, contributory and precipitating accident risk factors. These scenarios are discussed with regards to the functionality active safety technologies and automotive systems designs with special emphasis on the driver's needs, the safety functions needed to fulfill these needs and contextual constraints.

Keywords: accident causation, driver perception, active safety systems, vehicle design

AUTOMOTIVE SAFETY DESIGN IN CONJUNCTION WITH ATD DEVELOPMENT (DAS6)

Moustafa MOUSTAFA, *M.Moustafa@lboro.ac.uk* Loughborough University, LE11 3TU, Leicestershire, UK
B Serpil ACAR, *B.S.Acar@Lboro.ac.uk* Loughborough University, LE11 3TU, Leicestershire, UK

ABSTRACT

Crash tests have made significant contributions to vehicle design and occupant safety over the years. There are limitations of experimental tests regarding the models representing vehicle occupants. In this paper the use of human cadavers, animals and living people are mentioned briefly and development history of crash test dummies and developments in occupant safety are explained. The aim of this paper is to investigate the connection between the development of Anthropometric Test Devices (crash test dummies) and improvements in designs for the safety of vehicle occupants. Evolution stages of automotive safety design and Anthropometric Test Devices (ATD) are associated and examined together. The improvements in the design of passive safety devices such as seat belts, airbags, and head restraints are studied as well as the developments in physical models representing humans.

Keywords: Crash test dummy, ATD, automotive safety, design, seat belt, airbag, head restraint

DEBRIS ACCUMULATION PHENOMENA IN MICRO ELECTRIC DISCHARGE MACHINING OF MICRO HOLES (MM1)

Bülent EKMEKCİ, *bekmekci@hotmail.com* Karaelmas University, 67100, Zonguldak Turkey
Atakan SAYAR, *atakansayar@gmail.com* Karaelmas University, 67100, Zonguldak Turkey
Tahsin Tecelli ÖPÖZ, *t.t.opoz@hud.ac.uk* Atılım University, 06836, Incek, Ankara, Turkey
Abdulkadir ERDEN, *aerden@atilim.edu.tr* Atılım University, 06836, Incek, Ankara, Turkey

ABSTRACT

Origin of concavity shaped end tip formation in micro electric discharge machined blind micro holes is investigated. Open gap voltage, pulse energy and tool rotation speed are examined as varying parameters during the experiments. To observe the influences of investigated parameters, a series of micro-holes were machined and cut from cross sections for micro structural examinations. Unconventional etching agents were applied to the samples to reveal different micro constitutes within heat-damaged layers. Moreover, tool electrodes were also examined using scanning electron microscopy to explore the interactions with the work material and to compare with the end tip geometry of machined micro hole. It was observed that debris particles produced accumulated at tip of a micro hole especially when fine machining conditions are set and act as parabolic shaped electrodes during discharging. Thus this phenomenon in micro electric discharge machining of blind micro holes is presented to describe the wear mechanism at the end tip.

Keywords: Micro-EDM, Micro-Hole, Micromachining, Surface integrity

A MODEL FOR BENDING, TORSIONAL AND AXIAL VIBRATIONS OF MICRO-DRILLS (MM2)

Sinan Filiz, *sinanf@bilkent.edu.tr* Bilkent University, 06800, Ankara, Turkey
O. Burak Ozdoganlar, *burakoz@andrew.cmu.edu* Carnegie Mellon University, Pittsburgh, PA 15213, USA

ABSTRACT

This paper presents an accurate model for the dynamics of micro-drills. The boundary-value problem is solved by applying a spectral-Tchebychev technique. An experimental study is conducted to validate the micro-drill-dynamics model. Modal experiments of micro-drills are performed by exciting the drills with small piezoelectric elements directly attached to the drill body. The response measurements are conducted using a laser Doppler vibrometer system. In the validation study, three micro-drills with different geometric parameters are used. It was observed that the model can predict both bending and torsional-axial natural frequencies and mode shapes of the micro-drills (up to 90 kHz) with better than 4.5 % accuracy, and with an average absolute error of 1.5 %. For each case, the natural frequencies are also compared to those from finite-element models. The natural frequencies from the presented model and finite-element models are seen to match with better than 1.5 % accuracy. It is concluded that the model can be used for accurate and efficient prediction of micro-drill dynamics.

Keywords: Micro-drills, vibrations, vibration modeling, spectral solution, Tchebychev polynomials, experimental modal analysis

TECHNOLOGICAL ADVANCES IN MICRO-MANUFACTURING (MM3)

Emrullah Korkmaz, emrullah@*bilkent.edu.tr*, Bilkent Universitesi 06800, Ankara
Yiğit Karpat, *ykarpat@bilkent.edu.tr*, Bilkent Universitesi 06800, Ankara
Sinan Filiz, *sinanf@bilkent.edu.tr*, Bilkent Universitesi 06800, Ankara

ABSTRACT

Applications such as medical, biotechnology, commercial, aerospace and energy storage/conversion increasingly require miniature parts with micro-scale features. Special techniques and strategies have to be employed to fabricate micro-scale parts. Commonly used techniques are micro-machining, micro-forming, laser micro-machining, laser micro-sintering, micro electro discharge machining and micro injection molding. Miniature robotic devices and micro-grippers are used to assemble micro-systems from micro-parts. This paper outlines the application areas of micro-manufacturing and summarizes the capabilities of the aforementioned micro-manufacturing techniques.

Keywords: Micro-manufacturing, micro-assembly, micro-machining, micro-forming, laser micro-manufacturing, laser micro-sintering, micro electro discharge machining, micro injection molding.

ROBUST EXPERIMENTAL DESIGN OF MACHINING PROCESS OF MARTENSITIC STAINLESS STEEL WITH A CERAMIC TOOL (PDMS1)

Erdem ACAR, *acar@etu.edu.tr*, TOBB University of Economics and Technology, 06560, Soğutozu, Ankara, Turkey
Necip CAMUSCU, *ncamuscu@etu.edu.tr*, TOBB University of Economics and Technology, 06560, Soğutozu, Ankara, Turkey
Ali Osman ER, *er@kku.edu.tr*, Kırıkkale University, 71450, Kırıkkale, Turkey
Ersan ARSLAN, *e.aslan@alparslan.edu.tr*, Mus Alparslan University, 49100, Mus, Turkey

ABSTRACT

High hardness and wear resistance of Al2O3-based ceramics made them one of the most suitable cutting tool materials for machining hardened steels. However, the large amount of uncertainty in their fracture behavior usually results in unexpected catastrophic failures. This requires investigation of the effect of cutting parameters on machinability of hardened steels with Al2O3 based ceramic cutting tools, and determination of the optimal values of cutting parameters. An experimental study, by employing Taguchi techniques, is performed for analyzing the effects of three cutting parameters, namely cutting speed, feed rate and depth of cut on two performance measures, flank wear and surface roughness. Finally, the optimal cutting parameters for each performance measure are obtained.

Keywords: Metal cutting; Hardened steels; Experimental design; Taguchi techniques; Analysis of variance; robust optimization

EFFICIENT RELIABILITY ASSESSMENT OF HIGHLY SAFE MECHANICAL SYSTEMS THROUGH GUIDED TAIL MODELING (PDMS2)

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

ABSTRACT

The classical tail modeling is based on performing a relatively small number of limit-state calculations through Monte Carlo sampling, then fitting a generalized Pareto distribution to the tail part of the data. The limit-state calculations that do not belong to the tail part are discarded. To reduce the amount of discarded data, this paper proposes an efficient tail modeling procedure based on guiding the limit-state evaluations towards sampling points that have high chances of yielding limit-state values falling into the tail region. The guidance of the limit-state evaluations is achieved through a procedure that utilizes limit-state approximation and distribution fitting. The accuracy of the proposed method is tested through two structural mechanics problems, and it is found that the accuracy of reliability estimations can be significantly increased compared to classical tail modeling techniques for the same number of limit-state function evaluations.

Keywords: Tail modeling, high reliability, efficient reliability assessment

REVIEW OF APPROXIMATION METHODS FOR STRUCTURAL RELIABILITY ANALYSIS (PDMS3)

Irfan Kaymaz, *ikaymaz@atauni.edu.tr,* Ataturk University, 25240, Erzurum

ABSTRACT

Approximation methods are widely used to alleviate the computational burden of general engineering analyses. In reliability analysis, however, additional burdens can be brought on since it requires using iterative numerical methods or more costly simulation methods to estimate the probability of failure of the mechanical components/systems. Therefore, using approximation methods for real engineering applications is inevitable, by which a metamodel is used in place of a time consuming analysis. Therefore this paper reviews the most widely used approximation and design of experiment techniques in terms of developing a better metamodel for structural reliability problems. Two selected examples are provided in order to show the application of the approximation methods to a reliability analysis.

Keywords: response surface method, Kriging, model validation

IMPLEMENTATION OF A RELIABILITY BASED DESIGN ALGORITHM FOR HIGH-FIDELITY STRUCTURAL OPTIMIZATION OF AN AIRCRAFT WING (PDMS4)

Melike NİKBAY, *nikbay@itu.edu.tr* Istanbul Technical University, 34469, Istanbul, Turkey
Muhammet Nasıf KURU, *mkuru@itu.edu.tr* Istanbul Technical University, 34469, Istanbul, Turkey
Semra BAYAT, *bayat@itu.edu.tr* Istanbul Technical University, 34469, Istanbul, Turkey
Necati FAKKUSOĞLU, *fakkusoglu@itu.edu.tr* Istanbul Technical University, 34469, Istanbul, Turkey

ABSTRACT

We present reliability-based design optimization of a simple aircraft wing based on performance measure approach. CATIA is used as a parametric solid modeler while ABAQUS is used to compute the structural response of the wing system. As an optimization driver, ModeFrontier, is used with sequential quadratic programming method. The core of the problem leans on the structural optimization of a statically loaded wing. Weights and modal frequencies of that wing are optimized with stochastic parameters. The uncertainties concerning both yield strength and Young's modulus of the Aluminum material will be analyzed by the reliability analysis code developed in MATLAB.

Keywords: Structural Optimization, Reliability Analysis, Aircraft Wing, RBDO

EFFECTS OF OBLIQUE IMPACT ON MICRON SCALE PARTICLES (E06)

Baran YILDIRIM, *yildirim.ba@neu.edu* Northeastern University, 02115, Boston MA, USA
Sinan MÜFTÜ, *s.muftu@neu.edu* Northeastern University, 02115, Boston MA, USA
Andrew GOULDSTONE, *a.gouldstone@neu.edu* Northeastern University, Boston MA, USA

ABSTRACT

Deformation behavior of 50 μm sized single particles upon high velocity impact is investigated using the finite element method. The effects of impact velocity and impact angle on the deformation of the particle and the substrate are examined. The effects of high strain rates and temperature on the material yield and failure are considered. Impact velocity and angle are shown to play an important role on the failure and deformation characteristics of the impact process, and rebound behavior of the particle. Both the particle and the substrate experience large strains in the contact interface, where material failure is likely to be due to shear instability. The amount of failed material is a non-linear function of impact angle, and it is maximized at 45 degrees. Oblique impacts are more likely to cause erosion of material from the substrate. This work also shows that the rebound kinetic energy decreases with increasing impact angle and velocity, creating conditions more suitable for a bonding mechanism to become successful.

Keywords: Numerical simulation, spherical particle, oblique impact, deformation behavior

EFFECTS OF CUBIC NONLINEARITY OF BEARING ON FRF OF SPINDLE SYSTEM AND ON STABILITY OF CUTTING PROCESS (E29)

Zekai Murat KILIC, *zmuratk@interchange.ubc.ca* The University of British Columbia, V6T 1Z4, Vancouver, Canada
H. Nevzat OZGUVEN, ozguven@*metu.edu.tr* Middle East Technical University, 06531, Ankara, Turkey
Yusuf ALTINTAS, *altintas@interchange.ubc.ca* The University of British Columbia, V6T 1Z4, Vancouver, Canada

ABSTRACT

Determining Transfer Function or Frequency Response Function of machine tool tip by hammer test cannot include effects of nonlinearities in the bearings which depend on magnitude of cutting force and cutting speed. Hence, using this Frequency Response Function may lead to inaccuracy in stability prediction. In this paper, nonlinearity at the bearings of spindle-tool system are investigated. Bearing response is approximated by cubic stiffness nonlinearity. Effect of magnitude of cutting force on stability of the cutting process is analyzed. Because of the softening spring effect of bearings, natural frequencies of modes affected from nonlinearity decreased, which caused the shifting of stability lobes to lower spindle speeds. Also, increasing number of teeth decreased the effect of structural nonlinearity on the stability of process.

Keywords: Chatter Stability, End Milling, Bearing Nonlinearity

PROCESS SIMULATION FOR 5-AXIS MACHINING USING GENERALIZED MILLING TOOL GEOMETRIES (E30)

Ömer M. ÖZKIRIMLI, *ozkirimli@sabanciuniv.edu,* Sabancı University, Manufacturing Research Laboratory, 34956, İstanbul
Erhan BUDAK, *ebudak@sabanciuniv.edu,* Sabancı University, Manufacturing Research Laboratory, 34956, İstanbul

ABSTRACT
Multi-axis machining (especially 5-axis machining) is widely used in precision machining for automotive, aerospace and die-mold manufacturing. The goal in precision machining is to increase production while meeting high part quality needs which can be achieved through decision of appropriate process parameters considering machine tool constraints (such as power and torque), chatter-free operations and part quality. In order to predict and decide on optimal process parameters, simulation models are used. In the literature, individual tool geometries for multi-axis machining are examined in detailed with different modeling approaches to simulate cutting forces. In this study, a general numerical model for 5-axis machining is proposed covering all possible tool geometries. Tool envelope is extracted from CAD data, and helical flutes points are represented in cylindrical coordinates. Equal parallel slicing method is utilized to find cutter engagement boundaries (CEB) determining cutting region of the tool surface. for each axial level in the tool axis direction. For each level uncut chip thickness value is found and total forces are calculated by summing force values for each point along the cutting flutes. For arbitrary cases forces are simulated and obtained results are experimentally verified.

Keywords: Multi-axis machining, APT tools, Process simulation, Tool engagement

A GENERIC POSTPROCESSOR FOR TABLE-TILTING TYPE FIVE-AXIS MACHINE TOOL WITH VARIABLE FEEDRATE (E36)

Yaman BOZ, *yboz@ku.edu.tr* Koc University, Mechanical Engineering Department, 34450 Istanbul, Turkey

Ismail LAZOGLU*, *ilazoglu@ku.edu.tr* Koc University, Mechanical Engineering Department, 34450 Istanbul, Turkey

ABSTRACT

Postprocessors are important tools for converting CAM output into the machine tool language in the form of G-codes. In general, a postprocessor is a kinematics solver which determines the kinematic configuration of the machine at a specific cutter location. Improvements in the machine tool and the machining process technologies increased the need for generic postprocessors in order to exploit the capabilities of the machine tools. Next generation machining technologies such as force based feedrate scheduling and toolpath optimization requires the implementation of the variable feedrate during toolpath which constitutes the aim of this paper. Therefore, this paper will introduce a generic postprocessor for table-tilting type five-axis machine tool with variable feedrate and a practical method for avoiding kinematic singularities. Finally, proposed approach will be validated via virtual machine simulation.

Keywords: Postprocessor, Inverse kinematics, Five-axis machining.

TEMPERATURE DEPENDENT FLOW SOFTENING OF TITANIUM ALLOY TI6AL4V: AN INVESTIGATION USING FINITE ELEMENT MODELING OF MACHINING (E21)

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

ABSTRACT

Titanium alloys are commonly used in the aerospace and the medical device industries due to their superior properties. There has been a considerable amount of research to better understand the serrated chip formation mechanism of titanium alloys. Finite element modeling is an indispensible tool that can be used to understand machining characteristics of titanium alloys. The goal of this study is to investigate the influence of the material constitutive model on the serrated chip formation. For this purpose, a new flow softening expression is integrated into the material model, which allows us to define flow softening as temperature-dependent. Various temperature-dependent flow softening scenarios are tested, and the results are validated using experimental data from the literature.

Keywords: Machining, Titanium alloys, Finite element modeling, Flow softening

EFFECT OF PUNCH NOSE RADII IN THE HYDROFORMING OF TITANIUM ALLOY Ti-6Al-4V (E24)

Shahram Abbasnejad Dizaji, *abbasnegzad@gmail.com,* ***Master*** of Sci. Mechanical Eng. Dept., Iran Uni. Of Sci. and Tech. Tehran, Iran,
Hassan Nezami, *eng_h_nezami@yahoo.com,* Master of Sci. Mechanical Eng. Dept., Iran Uni. Of Sci. and Tech. Tehran, Iran,
Faramarz Djavanroodi, *f.roodi@ic.ac.uk,* Assistant Prof., Mechanical Eng. Dept., Iran Uni. of Sci. and Tech. Tehran, Iran, Fax:+982177240203,
Rahim Khushehmehr, *rahim.khushehmehr@gmail.com,* Master of Sci. Mechanical Eng. Dept, Uni. Of Tabriz. Tabriz, Iran**,**

ABSTRACT

Sheet metal forming of light- weight materials like Aluminum and Titanium alloys have gained so much attentions lately. There are so many parameters which affect the process of the Hydroforming of these materials. Punch nose radii is one the important parameters which have been investigated in this paper. Different punch radii were utilized to plot the effects on the Pressure- Displacement diagram experimentally and numerically, and it was shown that punch radius has so much influences in the beginning of the deformation. Besides the effects of punch radius on Limit Drawing Ratio (LDR) is discussed, the lower the punch radius, the lower the LDR.

Keywords Titanium alloy; Sheet Hydroforming; Punch nose radii

THERMAL AND MECHANICAL ANALYSIS OF MACHINING TI6AL4V AND INCONEL 718 (E35)

Onur Demir, *ondemir@ku.edu.tr* Koç University, 34450, Istanbul
Coskun Islam, *cislam@ku.edu.tr* Koç University, 34450, Istanbul
Ismail Lazoglu, *ilazoglu@ku.edu.tr* Koç University, 34450, Istanbul
Ertem Aygin, *ertem.aygin@ge.com* GE Marmara Technology Center, 41170, Kocaeli
Cem Sipahioglu, *cem.sipahioglu@ge.com* GE Marmara Technology Center, 41170, Kocaeli
Ozgur Ilgaz, *ozgur.ilgaz@ge.com* GE Marmara Technology Center, 41170, Kocaeli
Onur Ates, *onur.ates@ge.com* GE Marmara Technology Center, 41170, Kocaeli

ABSTRACT

The current study analyzed mechanical and thermal effects of process parameters in machining of Ti6Al4V and Inconel 718. In this work, different cutting conditions were tested in dry conditions and the effects of rake angle, feed rate, and cutting speed on cutting forces were investigated. Also, temperature distribution on the rake face of the cutting tool was simulated. The turning process was chosen to be elementary orthogonal cutting and the tests were carried out with conventional uncoated carbide tools. In the experiments, cutting forces were collected for three levels of cutting speed, feed rate and cutting tool rake-angle.

Keywords: Orthogonal Cutting, Ti6Al4V, Inconel 718, Cutting Forces, Temperature

EXAMINING THE EFFECT OF LOT SIZES AND SETUP TIMES BY USING SIMULATION (E15)

Oytun ERDEN, *oerden@etu.edu.tr*, TOBB Ekonomi ve Teknoloji Üniversitesi, 06560, Ankara
Ahmet ÇUBUKCU, *acubukcu@etu.edu.tr*, TOBB Ekonomi ve Teknoloji Üniversitesi, 06560, Ankara
Nilgun FESCİOĞLU-ÜNVER, nfunver@etu.edu.tr, TOBB Ekonomi ve Teknoloji Üniversitesi, 06560, Ankara

ABSTRACT

Simulation is frequently used to solve production system problems. In this study, we try to determine the effects of different lot size and setup times for a firm in the aerospace industry, by using simulation. This study compares the time needed to complete the order and the work in process amounts for four manufacturing options which differ from each other by lot size and setup times. We used Arena software for this simulation. The results show that different options have different benefits and the management should use simulation together with cost-benefit analysis in order to make the correct decision.

Keywords:

Construction of Product Definition Data for Digital Manufacturing (E25)

H.Eğilmez, *hegilmez@tai.com.tr,* Turkish Aerospace Industries Inc., Ankara, Turkey 06980

C.Cangelir, *ccangelir@tai.com.tr*, Turkish Aerospace Industries Inc., Ankara, Turkey 06980

ABSTRACT

The power of Today's Computers and Software makes Products virtually manufactured and tested before physically manufactured in shop floors. This was realized by evolving from 2D representations to 3D definitions. This virtual world is now to extend from engineering centric PDM (Product Data Management) systems to enterprise PLM (Product Life-cycle Management) solutions. One of the most beneficial aspects of PLM tool is; its ability to integrate data and processes on single database. Methodologies like Concurrent Engineering uses these management tools in order to make unique design data is available to all related departments, so that these different departments can start their studies in advance of the final design being made released. Digital manufacturing is, in practice, an integrated suite of tools that work with Product Definition Data to support tool design, manufacturing process design, visualization, simulation, and other analyses necessary to optimize the manufacturing process. Construction of product definition data in an organized way is the first milestone of Digital Manufacturing.

In this presentation, concurrent and collaborative development period of product definition data is presented. As an important step of Digital Mock Up (DMU) management, product structure management in parallel with the project requirements by a configuration controlled manner will be examined. The types of different units that compose the DMU and their management will be mentioned. Case study of capturing of knowledge at different maturity levels and simulation of assembly sequence will be presented. Engineering changes and their impact to product is another topic worth to analysis.

Keywords: Concurrent Engineering, Product Structure, Digital Mock Up, Configuration Management, Process Simulation

UNCERTAINTY ANALYSIS METHODS FOR THE MEASUREMENTS OF COORDINATE MEASURING MACHINES (E38)

Ahmet Sözak, *asozak@mgeo.aselsan.com.tr*,ASELSAN, Ankara - Turkey
E. İlhan Konukseven, *konuk@metu.edu.tr*, Middle Eat Technical University Mechanical Eng. Dept., METU, Ankara Turkey
Melik Dölen, *dolen@metu.edu.tr*,Middle Eat Technical University Mechanical Eng. Dept., METU, Ankara Turkey

ABSTRACT

In this paper, measurement uncertainty of coordinate measuring machines (CMMs), which consist of uncompensated systematic errors and random errors, is analyzed. After the uncertainty sources are determined, they are estimated and quantified by using the "uncertainty budgeting", "comparison", "statistical evaluation by designing fractional factorial experiment" and "hybrid" methods. In addition, a simulation algorithm is designed to model the task specific measurement uncertainty of circle without using the repeated measurements. These methods are implemented on a retrofitted CMM (LK G90) with a workspace of 1000×900×600 mm. As a result advantages and disadvantages of each methods are discussed.

Keywords: Precision Engineering, Dimensional Measurement Uncertainty, Coordinate Measuring Machine, Kinematic and Geometric Error Modeling, Simulation.

EFFECT OF Zr ADDITION ON THE MECHANICAL BEHAVIOR, DUCTILITY AND WEAR RESISTANCE OF ALUMINUM GRAIN REFINED BY TITANIUM PLUS BORON (E03)

Adnan I.O.ZAID, *a_kilani@hotmail.com,* University of Jordan, 11821, Amman, Jordan
Safwan M.A. AL QAWABAH, *safwan_q@yahoo.com* Tafila Technical University, 11660, Tafila, Jordan

ABSTRACT

Aluminum and its alloys are the second most commonly used metal for a variety of engineering applications. They solidify in columnar structure with large grain size which normally affects their mechanical behavior and surface quality. It is now becoming customary in aluminum foundry to grain refine their structure by adding either titanium or titanium + boron to their melt before solidification.

In this paper, the effect of addition of Ti+B on the mechanical properties, ductility and wear resistance of commercially pure aluminum is investigated. Titanium and boron were added at a level of Al 4.6%Ti-0.92%B 0.15 % wt. This ratio corresponds to the peritictic limit on the Al-Ti-B phase diagram and is normally used for grain refining of aluminum.

It was found that addition of zirconium, Zr, to the commercially pure aluminum, Al, resulted in poisoning of its grains i.e. coarsening them, whereas addition of Zr to Al grain refined by Ti+B resulted in further refining of its grains. So this resulted in improvement of its mechanical behavior.

Regarding the effect of Zr addition on the wear resistance of Al or Al grain refined by Ti+B resulted in deterioration of the wear resistance particularly at low speeds and small loads.

Key Words: Aluminum, Grain Refinement, Titanium, Zirconium, Boron, Mechanical Behavior, Ductility, Wear resistance.

INVESTIGATION OF BURR HEIGHT IN FACE MILLING OF A284 STEEL (E08)

Erol KILIÇKAP, *ekilickap@dicle.edu.tr* Dicle University, 21280, Diyarbakır, Turkey
Mesut HÜSEYİNOĞLU, *mesuth@dicle.edu.tr* Dicle University, 21280, Diyarbakır, Turkey
Orhan ÇAKIR, *ocakir@dicle.edu.tr* Dicle University, 21280, Diyarbakır, Turkey

ABSTRACT

Burr formation is unavoidable in the most of machining processes such as milling, planning and drilling. It is defined as “the form of a rough strip metal at the edge of the workpiece adjacent to the machined surface”. This undesired formation causes various problems such as high machining cost due to additional finishing operations, assembly difficulties and dimensional inaccuracy and must be removed from the component before use. Therefore it is important to understand burr formation during any machining operation to solve related problems which adversely affect manufacturing cost due to requiring additional machining operation such as deburring and cleaning the finish part. The present study aims to examine burr formation in face milling operation. The experimental investigation is based on the influences of selected machining parameters (cutting speed, feed rate and depth of cut) on burr height in the face milling of A234 steel. It was observed that the burr height affected by cutting speed, feed rate and depth of cut. The smallest burr height was obtained by using the highest cutting speed and the lowest feed rate and depth of cut values.

Keywords: Face milling, burr formation, burr height, machining parameters

THE CUTTING EDGE OF RFID TECHNOLOGY AND APPLICATIONS FOR MANUFACTURING SYSTEMS (E18)

Vahid BAGHERPOOR, *vahid.bagherpoor@cc.emu.edu.tr* Eastern Mediterranean University, Gazimagusa, North Cyprus
Majid HASHEMIPOUR, *majid.hashemipour@emu.edu.tr* Eastern Mediterranean University, Gazimagusa, North Cyprus
Hamed FARAHANI MANESH, *hamed.farahani@emu.edu.tr* Eastern Mediterranean University, Gazimagusa, North Cyprus

ABSTRACT

Wireless Manufacturing relies significantly on wireless devices such as RFID (Radio Frequency IDentification) or Auto ID (Automatic IDentification) sensors, and wireless communication networks. The state-of-the-art and recent developments in RFID-based wireless manufacturing systems are reviewed. The study is conducted by examining related case reports and research articles available in the literatures in order to explore the industrial and consumer applications of RFID. Finally, the authors propose the Virtual Factory-based (VF) methodology and guidelines for design and development of RFID based manufacturing systems.

Keywords: Wireless Manufacturing, Smart Parts, Radio Frequency Identification, Virtual Factory

A COLLABORATION FRAMEWORK FOR PRODUCT DATA MANAGEMENT AND EXCHANGE BASED ON OPEN STANDARDS AND SOA (E27)

Tahir FİDAN, *tfidan@aselsan.com.tr* ASELSAN A.Ş., 06370, Ankara, Turkey
Özgür ÜNVER, *hounver@gmail.com, TOBB-ETU, 06560, Ankara, Turkey*
S. Engin KILIÇ, *kilic@metu.edu.tr* Middle East Technical University, 06531, Ankara, Turkey

ABSTRACT

In an extended enterprise, where enterprises mutually associate their strengths, product data /process complexity and application diversity lead to islands of data. Product and process data management, sharing and exchange through standard schemas; application integration by the use of enabling information technologies is the lifeblood for collaboration and innovation. In past decennium, PDM/PLM was the integration solution systems proposed. However, the lack of interoperability between the actor applications in the product lifecycle and heterogeneity of COTS applications were significant drawbacks. This paper proposes a conceptual service oriented and STEP based collaborative engineering framework for application integration and product data management/ exchange problem.

Keywords: PDM, PLM, Collaboration, SOA, STEP, Web Services

A CONCEPTUAL STUDY ON RESPONSIVE AND RECONFIGURABLE AGENT BASED PRODUCT DEVELOPMENT SYSTEM (E28)

Tahir FİDAN, *tfidan@aselsan.com.tr* ASELSAN A.Ş., 06370, Ankara, Turkey
Özgür ÜNVER, hounver@gmail.com, TOBB-ETU, 06560, Ankara, Turkey
S. Engin KILIÇ, *kilic@metu.edu.tr* Middle East Technical University, 06531, Ankara, Turkey

ABSTRACT

Companies should implement new product development strategies to be able to respond unpredictable requirements of the market, new product demands and changes in the existing products, rapidly. In this paper, to overcome the responsiveness challenge, a conceptual product development framework is proposed. Three major functionalities of the framework: (1) harmonize artificial intelligence techniques (Case Based Reasoning) into the product development activities, (2) regulate the design candidate's selection process with new fuzzy approaches and (3) integrate the product development activities with reconfigurable manufacturing systems, by using Analytical Hierarchical Process and configuration stages. The proposed system will construct a solid base for Intelligent Factories.

Keywords: Case-Based Reasoning, Multi-Agent Systems, Fuzzy Systems, Analytical Hierarchical Process, Responsive Product Development, Reconfigurable Manufacturing Systems.

USE OF AHP FOR IMPROVING THE CREATIVITY IN INTRODUCTORY ENGINEERING DESIGN COURSE (E32)

Merve Hande ERGİN, *mergin@atilim.edu.tr* Atılım Üniversitesi, 06836, İncek-Ankara

ABSTRACT

Assessing the students' needs and expectations considering their knowledge and skills is essential for the development of the course. The instructor should develop a methodology to catch the student in teaching the course effectively. This paper presents the use of Analytical Hierarchy Process (AHP) approach in improving the creativity of the students in introductory engineering design course. The findings will help the instructor to improve and modify the delivery of the course to meet the course objectives as described in ABET 2000.

Keywords: Engineering design, AHP, Creativity

BEHAVIOUR-BASED MODELLING APPROACH FOR THE CONCEPTUAL DESIGN OF MECHATRONIC SYSTEMS USING DISCRETE EVENT SYSTEM SPECIFICATION (DEVS) FORMALISM (E34)

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

ABSTRACT

Mechatronic systems are multi-domain systems and their conceptual design needs a special approach which is different than conventional single-domain engineering design problems simply because of the need for integrating several types of energy behaviors in a physically integrated system. This paper presents an initial modeling approach to represent the intended operational behavior of a non-existent mechatronic system at early conceptual level. In this approach, the operational behavior is represented using Discrete Event System Specification (DEVS) formalism independent of any physical embodiment at a high level of abstraction. The approach is used to represent the operational behavior of a non-existent robot for educational purposes.

Keywords: Behavior-based modeling, Conceptual Design, Mechatronic Design, Discrete Event System Specification

DEVELOPMENT OF A FOUR FINGERED ROBOTIC HAND (E07)

Burak DOĞAN, *budogan@tai.com.tr* Turkish Aerospace Industries, 06980, Ankara, Turkey
Bilgin KAFTANOĞLU, *bilgink@atilim.edu.tr* Atılım University, 06836, Ankara, Turkey

ABSTRACT

In this study, a four fingered robotic hand is presented. The considered hand has 4 degrees of freedom. The fingers of the hand can be controlled by the software developed for gripper, through joints where pneumatic actuators are placed. The user can control the fingers of the hand in order to grasp various objects. Hand can be attached to an industrial robot as an end effector. Also the developed hand can be used as a multipurpose gripper as it is designed for universal gripping tasks.

Keywords: Robotic Hand, Robotic Gripper, Kinematic Analysis

DEVELOPMENT OF REHABILITATION DEVICE FOR FINGER JOINTS (E10)

Shigeaki HATA, *g0981218@tcu.ac.jp*, Tokyo City University, Tokyo, Japan
Shigeo HIRANO, *shirano@tcu.ac.jp*, Tokyo City University, Tokyo, Japan
Hideo SAKAI, *hsakai@tcu.ac.jp*, Tokyo City University, Tokyo, Japan

ABSTRACT

Along with the problems associated with aging, an increase in the number of orthopedically impaired people owing to various disorders and a shortage of nurses are expected. We design our device to have small size, light weight, and a simple mechanism. The most important concept behind rehabilitation is to provide a basic rehabilitation service to as many patients as possible. In this study, with the aim of practical application in the future, we have developed a rehabilitation device that is particularly effective for finger joints, which play the most important role in daily life activities among the upper limb functions.

Keyword: Rehabilitation, Finger Joints, Development Design

ROBUST DESIGN METHOD FOR OBJECTIVE CHARACTERISTICS WITH NONNORMAL DISTRIBUTIONS AND CONTROL FACTORS WITH ADJUSTABLE RANGE (E05)

Takeo KATO, *takeo_kato@2005.jukuin.keio.ac.jp*, Keio University, 223-8522, Yokohama, Japan
Atsuki WATAI, *watai@a7.keio.jp, Keio University*, 223-8522, Yokohama, Japan
Yoshiki UJIIE, *ujiie@mech.keio.ac.jp*, Keio University, 223-8522, Yokohama, Japan
Yoshiyuki MATSUOKA, *matsuoka@mech.keio.ac.jp*, Keio University, 223-8522, Yokohama, Japan

ABSTRACT

This study demonstrates a robust design method for two design problems. One problem is that an objective characteristic is in a nonnormal distribution. To deal with this problem, we propose an index to estimate the feasibility of an objective characteristic within a tolerance. The other problem is when a control factor has an adjustable range that enables users to adjust to meet their needs. To derive the optimum adjustable range, we propose an index to estimate the ratio of the sum of sets of the probability of an objective characteristic within the tolerance. The proposed method is applied to a public seat design.

Keywords: Robust design, Design methodology, Seat design

CONCEPT OF *KANSEI* AND THINKING IN DESIGN THEORY (E12)

Ryo IWATA, *g0991201@tcu.ac.jp*, Tokyo City University, Tokyo, Japan
Shigeo HIRANO, *shirano@tcu.ac.jp*, Tokyo City University, Tokyo, Japan

ABSTRACT

In this study, we discuss the concepts of *kansei* and thinking in design theory considering that the effect of subjective decisions made by a designer on the design process is significant. It has become clear that the methodology of quantifying the processes associated with *kansei* and the thinking process in design theory through statistical analysis is under establishment in the research of *kansei* engineering. However, the methodology of conceptualizing the ideas developed by a designer following his/her own *kansei* and thinking has not yet been established.

Keyword: Design Theory, *Kansei*, Design Thinking Process, Graphic Thinking, Idea

TOWARDS DEVELOPMENT OF A NEW BIOMIMETIC/BIOINSPIRED DESIGN METHODOLOGY (E33)

Aylin KONEZ EROĞLU, *akonez@atilim.edu.tr* ATILIM University, 06836, Ankara, Turkey
Zühal ERDEN, *zuhal@atilim.edu.tr* ATILIM University, 06836, Ankara, Turkey
Abdulkadir ERDEN, *aerden@atilim.edu.tr* ATILIM University, 06836, Ankara, Turkey

ABSTRACT

A biological inspiration process called as “Biomimetic” or “Bioinspired” aims to develop creative and novel artificial products in engineering domain via inspiring ideas from structures, materials, processes, and functions in biology domain. Developing of a systematic biomimetic/bioinspired design (BID) is challenging for engineers for many reasons, such as; low cost, high efficiency, and high reliability. Many case studies are available in literature. There are mainly two design approaches based on the starting point of the design. One of them is the “problem-based design” approach in which the design starts with an engineering problem and the other is the “solution-based design” approach which starts by selecting of a biological system. This paper presents an extensive literature overview on BID and compares problem-based and solution based BID approaches. This survey forms a basis for the development of a new BID approach to design hybrid systems at conceptual level.

Keywords: Biomimetic, Bioinspired, Design Methods, Hybrid Systems

EFFECT OF ADDITION OF TANTALUM (Ta) ON THE MECHANICAL BEHAVIOUR ON THE FATİGUE LİFE OF THE ZİNC-ALUMİNİUM ALLOY 5 (ZA5) (E01)

Adnan .I.O. ZAID,*a_kilani@hotmail.com* Industrial Department Jordan University, Amman, Jordan.
Du'a .O.R.WERAIKAT,*weriakat@yahoo.com* Industrial Department Jordan University, Amman, Jordan.

ABSTRACT

The use of Zinc-aluminium alloys in general and Zinc-aluminium 5 alloy have spread in the last two decades in industrial applications, due to their resistances to wear and corrosion. These alloys normally solidify in coarse dendritic structure which affects their surface quality and mechanical behaviour. Therefore, their structure is normally refined by rare earth materials e.g. titanium, titanium+boron or zirconium.

In this research the effect of addition of Tantalum to ZA5 at the following percentages: 0.02%, 0.04%, 0.06%, 0.08% and 0.10% on its microstructure, hardness, mechanical behaviour, and fatigue life is investigated.

The results of this work revealed, within the experimental range, that the addition of Tantalum as grain refiner at all rates resulted in changing the coarse dendritic structure of ZA5 into fine nodular one which resulted in enhancement of its hardness and flow stress.

It was also found that addition of 0.04% Tantalum to ZA5 resulted in enhancement of its flow stress, and the fatigue life at a stress level of 160 MPa. However, addition of Ta at a rate percentage higher than 0.04% and at stress level exceeding 160 MPa resulted in deterioration of its fatigue life.

Keywords: Zinc-Aluminium 5 Alloy, Tantalum, Fatigue life

EFFECT OF ZIRCONIUM ADDITION ON CHEMICAL CORROSION RESISTANCE OF ALUMINIUM GRAINS REFINED BY TITANIUM IN ACIDIC AND ALKALINE SOLUTIONS (E02)

Adnan I.O. ZAID, *a_kilani@Hotmail.com, University of Jordan, Amman, Jordan.*

Nader A. B. AL THEEB, *naderdolat@yahoo.com, University of Jordan, Amman, Jordan.*

ABSTRACT

In this paper, the effect of some grain refiners on the chemical corrosion resistance of commercially pure aluminium is investigated. Three micro alloys and aluminium specimens were tested in Hydrochloric acid solutions and in sodium hydroxide solutions. it was found that addition of either Ti or Zr to aluminium resulted in enhancement of its corrosion resistance in hydrochloric acidic solutions giving higher resistance in case of Zr addition, the average enhancement percentage is 17.3% and 25.4% respectively. However, addition of both Ti and Zr together resulted in deterioration of its corrosion resistance by an average of 10.7%. This reflects that their effect regarding corrosion resistance is not additive.

Regarding the addition of these refiners on the corrosion resistance of aluminium in sodium hydroxide alkaline solutions, it was found that addition of either Ti or Zr alone resulted in deterioration of its corrosion resistance, within the concentration levels tested in this work. The average deterioration percentage is 9.6% and 15.5% respectively. In case of addition of Ti and Zr together below 0.1 molarity resulted in enhancement of its corrosion resistance by an average of 3.05%, and resulted in deterioration above 0.1 molarity by an average of 5.7%.

Keywords: Aluminium, Corrosion, Grain Refinement, Titanium, Zirconium.

VARIATION OF ENGINE PERFORMANCE AND EMISSIONS USING ETHANOL BLENDS (E23)

Abdullah ABUHABAYA, *a.abuhabaya@hud.ac.uk* Yorkshire Huddersfield University, Queensgate, Huddersfield HD1 3DH, UK
John FIELDHOUSE, *j.d.fieldhouse@hud.ac.uk* Yorkshire Huddersfield University, Queensgate, Huddersfield HD1 3DH, UK

ABSTRACT

The limited fossil fuel resources along with the increased public concerns about pollution levels have increased the need for alternative fuels for use in internal combustion engines. This study is to investigate the variation of the engine performance and exhaust emissions of a spark ignition engine. A spark ignition engine running with gasoline and gasoline blended E5, E10 and E20 (E5, that mean 5% of ethanol and 95% of gasoline by volume). Effects of engine speeds of 1000, 1500, 2000, 2500, 3000 and 3500 rpm and throttle valve 25%, 50%, 75% and 100% full throttle, on the engine performance and the emission concentrations are investigated. Improved engine performance and reduced emissions are observed with ethanol addition. The results showed that the engine brake torque was increased with engine speed. Ethanol blends produced higher torque, compared with gasoline. Lowest brake thermal efficiencies are found for gasoline, for all speeds. All blends showed recognised increase in the brake thermal efficiency with the speed. Also the results showed that the emissions level of blends was reduced the Carbone monoxide CO, oxides of nitrogen NO_x and unburned hydrocarbons concentrations. Blends with maximum alcohol content E20 produced lowest CO and HC emissions, camper with the other fuels at any position. The experimental results have been introduced and discussed with respect to either engine speed up to 3500 rpm or the throttle valve setting up to 100%. The experimental apparatus used to conduct the experiments was designed to facilitate good control on the performance parameters and ease of data collection. The levels of carbon monoxide (CO), unburned hydrocarbons (HC) and nitrogen oxides (NO_x) are measured at various operating conditions.

Keywords Fossil fuel, Alternative fuels, Biofuel, Engine performance, Exhaust emissions

EXPERIMENTAL INVESTIGATION OF USE OF CANOLA OIL AS A DIESEL FUEL (E37)

Demir Bayka, Middle East Technical University
Ali Özdemir, T.C. Karayolları

ABSTRACT

Unesterized canola oil is utilized for the test on a naturally aspirated, 4 stroke, 4 cylinders, water cooled, direct injection diesel engine. The effect of pure canola oil as an alternative fuel on engine performance and exhaust emissions is investigated. The high viscosity of canola oil is reduced by heating prior to injection by modifying the fuel delivery system. Also, 30% ethanol is mixed with canola oil to reduce the viscosity. Engine performance is evaluated at full load-variable speed. Also, 13 mode ESC test cycle is performed to determine the exhaust emissions. Results are compared with baseline diesel fuel. Experimental results show that that engine performance decreased for canola oil. Addition of ethanol into canola oil improved performance with respect to pure canola oil. Although, maximum performance has been obtained with diesel fuel, minimum specifics energy cost is obtained with canola oil. Hydrocarbon (HC) emissions decrease with canola oil, blending ethanol with canola oil increase HC emissions and maximum values are read for diesel fuel. Carbon monoxide (CO) emissions are highest for canola oil but blending ethanol has a decreasing effect on CO emissions. Canola oil increased particulate matter emissions but adding ethanol in canola reduced particulate matter emissions significantly. Pure canola oil can be used without any engine modification as an alternative fuel.

Key-words: Diesel Engine Canola Oil, Alternative Fuel

PRODUCTION AND ASSESMENT OF COMPACTED GRAPHITE IRON DIESEL ENGINE BLOCKS

Ali KALKANLI, *kalkanli@metu.edu.tr* Orta Doğu Teknik Üniversitesi, 06531, Ankara

Anıl ALKAN *aanil.alkan@gmail.com* Orta Doğu Teknik Üniversitesi, 06531, Ankara

Sema BAHSİ *semabashi@odoksan.com.tr* ELBA Basınçlı Döküm Osmaneli ODÖKSAN Döküm Fab

Cemal GÜVEN *cguven@odoksan.com.tr* ELBA Basınçlı Döküm Osmaneli ODÖKSAN Döküm Fab

ABSTRACT

Diesel engine blocks properties such as tensile strenght, heat conductivity, sound damping, engine vibration and noise are strongly influenced by graphite shape and volume percent in the matrix microstructure. The shape and volume percent of the graphite particles are characterized by image analize systems. In this study, the engine blocks were produced at ELBA Basınçlı Döküm Odöksan Cast iron foundry in Osmaneli Turkey by furan resin sand and liquid alloy were treated with Mg by using ladle method. Each engine block is approximately 125 kg. To meet the current and future requirements of cars and truck diesel engines, compact graphite in the matrix alloy is required as at least 75% by volume. CGI ırons has better properties compare to gray irons, by treating the base alooy with Mg an increase in UTS 40%, increase in elastic modulus and approximately double the fatigue strength of grey cast iron can be achived [1] The main purpose of this study is to achive %20 -25 volume nodularity and remaining is compacted graphite in the produced engine blocks.

Keywords: Compacted graphite iron, engine block, Mg:S ratio, solidification simulation

GEAR INVESTIGATIONS BASED ON SURFACE CONSTRUCTOR KINEMATICAL MODELLING AND SIMULATION SOFTWARE (E04)

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

ABSTRACT

The paper introduces the latest results achieved using the Surface Constructor computer program, which is intended for accomplishing gear investigations, development and innovation. The first part introduces the Reaching Model conjugate surface generating theory as the core of the kinematical modelling and simulation software application. Then a short description summarizes the structure and the capabilities of the tool. Finally, concrete examples demonstrate the versatility of the application in modelling the meshing of gears.

Keywords: Gears, Simulation, Worm, Point-like contact

LASER-ASSISTED BENDING: A TOOL FOR BRITTLE MATERIALS (E09)

F. Bammer, *f.bammer@tuwien.ac.at*, Vienna University of Technology, IFT, Vienna, Austria
T. Schumi, *schumi@ift.at,* Vienna University of Technology, IFT, Vienna, Austria
G. Humenberger, *humenberger@ift.at*, Vienna University of Technology, Vienna, Austria
D. Schuöcker, *lz@ooelz.at*, Laserzentrum Gmunden, Gmunden, Austria

ABSTRACT

Laser assisted bending is a new and versatile method to allow simple bending of brittle materials by illuminating and heating the forming zone with lasers. Only a laser allows directing the power on a narrow area. This decreases unwanted heating of other parts of the bending equipment, minimizes wear of the tool and, if properly done, avoids damage of the surface of the metal.

We first describe some preliminary tests showing the possibility to use diode laser bars in this application for Mg-, Ti-, Al-, and steel-alloys. Further we show the integration of these lasers in a lower tool that can be used in a conventional bending press. Further the use of a solid state laser is demonstrated. Experiments show the successful bending of brittle metal sheets in a process nearly as simple as conventional cold bending.

Keywords: Laser-Assisted Bending, Brittle Materials, Diode Lasers, Solid State Lasers

TÜRKÇE BİLDİRİLER
(İngilizce Özetler)

PAPERS IN TURKISH
(with English Abstracts)

TIG KAYNAĞI İLE BİRLEŞTİRİLMİŞ Al-SiC KOMPOZİT MALZEMELERİN EĞME DAYANIMININ YAPAY SİNİR AĞLARI İLE TAHMİNİ (T21)

Hülya DURMUŞ, *hulya.kacar@bayar.edu.tr*, Celal Bayar Üniversitesi, 45400, MANİSA
Selda AKGÜN KAYRAL, *selda.akgun@bayar.edu.tr*, Celal Bayar Üniversitesi, 45140, MANİSA
Salim ŞAHİN, *salim.sahin@bayar.edu.tr*, Celal Bayar Üniversitesi, 45140, MANİSA

ÖZET

Bu çalışmada, Al-SiC kompozitler toz metalurjisi yöntemiyle üretilmiştir. SiC takviye oranları, %2.5, 5, 7.5, 10, 15, 20 (%ağ.) dir. Matris Al tozları, SiC parçacıkları ile mekanik olarak karıştırıldı ve 10x10x55 mm boyutlarında, oda sıcaklığında 380 MPa basınçta sıkıştırıldı ve daha sonra 600°C sıcaklığında 1 saat sinterlendi. Kompozitler, Oerlikon Saxotig 160 AC/DC kaynak makinesi kullanılarak, TIG kaynağı ile birleştirildi. Kaynak işleminde 85 AC akım kullanıldı. Mekanik testleri yapıldı. Bu çalışmada da takviye oranları, sertlik ve çekme dayanımları kullanılarak eğme dayanımının Yapay sinir ağlarıyla tahmini yapılmıştır.

Anahtar Kelimeler: Al-SiC, TIG kaynağı, Yapay Sinir Ağları

ABSTRACT

In this study, Al-SiC composites were produced by PM method. In produced composites, rates of SiC are %2.5, 5, 7.5, 10, 15, 20 (%wt.). The matrix Al powders were mechanically mixed with SiC, compacted in room temperature at 380 MPa for 10x10x55mm specimens and followed by sintering at 600°C for 1 h. Composite specimens were joined by TIG welding method with use of Oerlikon Saxotig 160 AC/DC welding machine. 85 AC current was used at welding process. Mechanical tests were performed. In this study; Bend strength was found using of reinforced rate, hardness and tensile strength by Artificial Neural Network.

Keywords: Al-SiC, TIG welding, Artificial Neural Network.

İNELASTİK MALZEMELERDE MARTENSİTİK FAZ DÖNÜŞÜMLERİ

İstemi B. ÖZSOY, *iozsoy@etu.edu.tr*, TOBB Ekonomi ve Tekn. Üniversitesi, 06560, Ankara
Valery I. LEVITAS, *vlevitas@iastate.edu*, Iowa State University, 50011, IA, USA

ÖZET

Martensitik faz dönüşümleri (FD) doğada, fiziksel deneylerde ve modern teknolojilerde sıkça görülen bir olaydır. Bu dönüşümler şekil hafızalı alaşımların ana deformasyon mekanizmasını oluştururlar. İkizlenme, sanki-elastik ve sanki-plastik davranış ile bir ve iki yönlü şekil hafıza etkisine sebep olurlar. Bu dönüşümler esnasında cismin bazı bölgelerinde ortaya çıkan büyük dönüşüm gerinimi çok büyük gerilmelere sebep olur. Dönüşen bölgelerde ve çevresinde buna uyumlu inelastik gerinimler oluşur ve bu da FD'nin termodinamiğini ve kinetiğini değiştirir. Bu çalışmada inelastik malzemelerdeki martensitik mikroyapı gelişiminin modellenmesinde temel bir teori geliştirilmiştir. Türetilen denklemler martensitik FD geçiren bütün malzemeler için bünye denklemlerini olarak kullanılabilir.

Anahtar Kelimeler: Martensitik faz dönüşümleri, ikizlenme, plastisite, bünye denklemleri

ABSTRACT

Martensitic phase transformations (PT) are phenomena that are very widespread in nature, physical experiments and modern technologies. They represent the main deformation mechanism of shape memory alloys (SMA). They cause twinning, pseudoelasticity and pseudoplasticity phenomena, as well as one- and two-ways shape memory effects. The appearance of large transformation strain during such PTs in some regions of a body results in large stresses. The accommodational inelastic strains occur in the transforming regions and surroundings. This in turn affects the thermodynamics and kinetics of PT. In this study, a basic theory for modeling martensitic microstructure evolution in inelastic materials is developed. The derived equations can be used as constitutive equations for all materials that can undergo martensitic phase transformation.

Keywords: Martensitic phase transformations, twinning, plasticity, constitutive equation

AA5083 ALAŞIMIN FREZELENMESİNDE YÜZEY KALİTESİNİ ETKİLEYEN FAKTÖRLERİN İSTATİSTİKSEL OLARAK DEĞERLENDİRİLMESİ (T02)

Ahmet Murat PİNAR, *ahmet.pinar@bayar.edu.tr* Celal Bayar Üniversitesi, 45400, Turgutlu/Manisa
Enver ATİK, *enver.atik@bayar.edu.tr* Celal Bayar Üniversitesi, 45140, Muradiye/Manisa
Uğur ÇAVDAR, *ugur.cavdar@bayar.edu.tr* Celal Bayar Üniversitesi, 45140, Muradiye/Manisa
A. Faruk PİNAR, *faruk.pinar@bayar.edu.tr* Celal Bayar Üniversitesi, 45400, Turgutlu/Manisa

ÖZET

Yüzey kalitesi ürünün çalıştığı ortama göre, sistemin performansını, ömrünü ve verimini etkileyen en önemi kalite karakteristiklerinden biridir. Ortalama ve maksimum pürüzlülük yüzey kalitesinin değerlendirildiği en önemli yüzey parametreleridir. Çalışmada işlem parametrelerinin (kesme hızı, ilerleme oranı, işleme deseni ve talaş derinliği) ve bunlara ait ikili etkileşimlerin (Kesme hızı-ilerleme oranı, kesme hızı-işleme deseni ve ilerleme oranı-işleme deseni) bu iki yüzey parametresi üzerindeki etkileri Taguchi metodu ile incelenmiştir. Taguchi'ye ait standart L27 ortogonal dizi esas alınarak gerçekleştirilen deneyler, varyans analizi (ANOVA), faktörlere ait ana etkiler ve etkileşim grafikleri ile değerlendirilmiştir.

Anahtar kelimeler: Ortalama pürüzlülük, maksimum pürüzlülük, AA 5083, Taguchi metodu, ANOVA, Frezeleme, Cep işleme.

ABSTRACT

Surface quality is one of the most significant quality characteristics that affects the performance, life and efficiency of the system in terms of the environment where the product works. Roughness average and maximum height of the profile are the most important surface parameters where the surface roughness is evaluated. In the study, the effects of process parameters (cutting speed, feed rate, tool path pattern and dept of cut) and their two-way interactions (cutting speed-feed rate, cutting speed-tool path pattern, feed rate-tool path pattern) on these two surface parameters are investigated via Taguchi method. The experiments conducted based on Taguchi's standard L27 orthogonal array are evaluated with the analysis of variance, and main effects and interaction plots.

Keywords: Roughness average, maximum height of the profile, AA5083, Taguchi method, ANOVA, Milling, Pocket machining.

FREZELEMEDE TIRLAMA TİTREŞİMLERİ İÇİN SÜREÇ SÖNÜMLEME MODELİ (T06)

Erol TÜRKEŞ, *eturkes@dpu.edu.tr* Dumlupınar Üniversitesi, 43100, Kütahya

ÖZET

Bu çalışmada, frezelemede düşük ve orta kesme hızlarındaki tırlama titreşimlerinde meydana gelen Süreç Sönümleme Oranlarının (SSO) hesabı için analitik bir model önerilmiştir. Bu model, kesilme açısı (φ)'nın değişimi ve takım ucunun dalgalı yüzeye batmasıyla batma kuvvetlerinin değişimi temelinde oluşturulmuştur. Kesme sisteminin dinamik denklemleri her iki etkenin de hesaba katılarak bulunan SSO' na bağlı olarak ifade edilmiştir. SSO' nın nasıl değiştiği ve ne kadar olduğu da geleneksel Stabilite Lob Diyagramları (SLD)' nın analitiksel hesaplama prosedürünün tersten çalıştırılmasıyla araştırılmıştır. Önerilen model, frezeleme operasyonları için teoriksel olarak uygulanmış ve bu hesaplama yaklaşımıyla bulunan sonuçlar deneysel olarak da doğrulanmıştır.

Anahtar Kelimeler: Analitik model, Tırlama Titreşimi, Süreç Sönümleme

ABSTRACT

In this study, an analytical model is developed to predict Process Damping Ratios (PDR) in the chatter vibrations for low cutting speeds in milling. This model is constituted on the basis of the alteration of (φ) cutting angle of the shear tool bit and the alteration of the penetration forces when they penetrate into the wavy surface. Depending on PDR, the dynamic equations of the cutting system are described by a new model. Variation and quantity of PDR are predicted by reverse operated analytical calculation procedure of traditional Stability Lobe Diagrams (SLD). Developed model is performed theoretically for milling operations in this performance and simulation results are verified experimentally by cutting tests.

Keywords: Analytical model, Chatter Vibration, Process Damping

KESME PARAMETRELERİNİN KESME KUVVETLERİNE ETKİSİNİN DENEYSEL ARAŞTIRILMASI (T11)

İlhan ASİLTÜRK, *iasilturk@selcuk.edu.tr*, Selçuk Üniversitesi, 042075, Konya
Ali ÜNÜVAR, *aunuvar@selcuk.edu.tr*, Selçuk Üniversitesi, 042075, Konya
A.Serhat ERSOYOĞLU,*aersoy@selcuk.edu.tr*, Selçuk Üniversitesi,042075, Konya

ÖZET

Tornalamada kesme kuvvetlerinin incelenmesi yüzey kalitesi, takım aşınması, takım kırılması, kesme sıcaklıkları, kendiliğinden doğan ve zorlanmış titreşimler gibi kesme performansları ile kuvvetli bir korelâsyona sahip olması nedeniyle önemlidir. Bu çalışmada kesme kuvvetleri üzerine kesme parametrelerinin etkileri AISI 1040 çeliğinin çok katlı kaplanmış karbür takımlar kullanılarak tornalanmasında incelenmiştir. Deneyler üç seviyeli faktöriyel dizayn kullanan deneysel tasarım planı temel alınarak yapılmıştır. Deneysel sonuçlar kesme kuvvetleri üzerine kesme hızlarının etkisinin az olduğunu göstermiştir. Kesme derinliği ilerleme kuvveti üzerine %90.3gibi bir katkı sağladığı, ilerlemenin etkisinin ise %5.57 oranında olduğu görülmüştür. Radyal kuvvete ilerleme ve kesme derinliğinin katkıları %52 ve %38.7 olmuş ve ilerleme ve kesme derinliğinin iç etkisi %3.3 oranında katkı sağladığı görülmüştür. Asıl kesme kuvvetinin üzerine ilerleme ve demse derinliğinin katkıları sırayla %24.98 ve %67.58 olmuştur.

Anahtar sözcükler: Kesme parametreleri, Kesme kuvvetleri, Tornalama

ABSTRACT

Study of cutting forces is critically important in turning operations. because cutting forces correlate strongly with cutting performance such as surface accuracy, tool wear, tool breakage, cutting temperature, self-excited and forced vibrations. In the present study, an attempt has been made to investigate the effect of cutting parameters (cutting speed, feed rate and depth of cut) on cutting forces (feed force, thrust force and cutting force) in turning of AISI 1040 steel using multi-coated carbide tool. The machining experiments were conducted based on experimental design plan using three level factorial design. The results show that cutting forces do not vary much with experimental cutting speed in the range of 150-320 m/min . Depth of cut is the dominant contributor to the feed force, accounting for 90.3% of the feed force whereas feed rate accounts for 5.57% of the feed force. In the thrust force, feed rate and depth of cut contribute 52% and 38.7%, respectively, plus interaction effect between feed rate and depth of cut provides secondary contribution of 3.3%. In the cutting force, feed rate and depth of cut contribute 24.98% and 67.58% respectively.

Keywords: Cutting parameters, Cutting force, Turning

VİDALARIN TALAŞ KALDIRMA İLE İMALININ YAPISAL MODELİ (T05)

Eldar FETULLAZADE, *eldarf@erciyes.edu.tr,* Bozok Üniversitesi Mak.Müh.Böl., Yozgat
H.Kemal AKYILDIZ, *akyildiz@erciyes.edu.tr* ,Bozok Üniversitesi Mak.Müh.Böl, Yozgat
Haydar LİVATYALI, *livatyali@itu.edu.tr***,** İ.T Ü. Mak. Fakültesi, Gümüşsuyu, 34439 İstanbul

ÖZET

Bu bildiride hassas vidaların talaş kaldırma işlemi ile yüksek kapasite, yüksek güvenirlik ve düşük maliyetle açılmasını sağlayan bir yapısal modelin geliştirilmesi amaçlanmıştır. Modelin giriş, çıkış, fiziksel dönüşüm kısımlarının parametreleri, vidaların talaş kaldırma ile açılma özellikleri göz önüne alınarak geliştirilmiş ve onların aralarındaki karşılıklı ilişkiler gösterilmiştir. Vidaların talaş kaldırma ile imalinin entegre edilmiş fonksiyonel parametreleri (kesme sıcaklığı, kesme kuvveti, takımın aşınması) silindirik ve düzlemsel parçaların tornalama ile imalatından daha yüksek ve daha yoğundur. Bunun nedeni vida dişinin ve takımın konstrüksiyonunun talaşın oluşma koşullarını zorlaştırmasıdır. Talaş kaldırma sırasında vidaların diş dibindeki çekme gerilmelerinin vida güvenirliğini azaltmış olduğu açıklansa da bu konudaki deneysel çalışmaların yetersiz olduğu belirgindir.

Anahtar kelimeler: Yapısal Model, Talaş kaldırma, Vida açma, Güvenirlik

ABSTRACT

In this article, a structural model of the machining of the precision threads is developed for lowest cost, highest reliability and machining capacity. The parameters of the input, output and physical transformation modules of the model are designed by concerning thread machining properties and their interactive effects are also shown. It is seen that the integrated functional parameters of the thread machining such as cutting forces, cutting temperatures and tool wear are higher than turning of cylindrical and planar parts. The cause of this lies in the design of the thread and threading tool. It is beleived that tensile residual stresses at the roots of the threads reduce the reliability of the threads; however, there is no sufficient experimental evidence on this subject.

Key words: Structural model, Machining, Thread machining, Reliability

KÜÇÜK ÖLÇEKLİ AHŞAP PROFİLİ ÜRETİM SİSTEMİ TASARIMI (T14)

Yiğit TAŞCIOĞLU, *ytascioglu@etu.edu.tr*, TOBB Ekonomi ve Teknoloji Üniversitesi, 06560, Ankara
Mike R. JACKSON, *m.r.jackson@lboro.ac.uk*, Loughborough University, LE11 3TU, Loughborough

ÖZET

Klasik profil makinalarının takım ve kayıp-zaman maliyetlerinin dengelenemeyeceği düşük hacimli üretim koşullarında kullanılmak üzere sabit maliyeti düşük, üretim esnekliği yüksek bir ahşap profili üretim sistemi geliştirilmektedir. İki eksen üzerinde bilgisayar denetimli konumlanabilen tek bir kesici takım kullanarak herhangi bir profili direkt CAD bilgisinden üretmeyi amaçlayan sistemin PC tabanlı prototipi üretilmiş, kontrol yazılımı ve grafik arayüzü Visual Basic programlama dili kullanılarak gerçeklenmiştir. Sistemde üretilen profillerin hedeflenen ürün kalitesine ulaştığı ancak üretim hızı hedefinin henüz yakalanamadığı görülmüş ve nedenleri açıklanmıştır.

Anahtar Kelimeler: ağaç işleri, ahşap profiller, PC-tabanlı kontrol, PIMM.

ABSTRACT

This paper presents a flexible wood-moulding system aimed at low volume production where the tooling and set-up costs of the conventional moulders cannot be compensated. The concept of the system is to produce any moulding profile directly from CAD data by using a single cutting tool mounted on a computer controlled two-axis manipulator. A PC controlled prototype is built and Visual Basic is used for control implementation and GUI. It is shown that the target product quality is achieved but the production rate is yet to be improved.

Keywords: wood machining, wood moulding, PC-based control, PIMM.

DAİRE KESİTLİ YAYLARIN KALIP YAYI OLARAK KULLANILABİLİRLİĞİNİN İNCELENMESİ

Demet GÖNEN, *dgonen@balikesir.edu.tr,* BAÜ. Endüstri Mühendisliği Bölümü,10145-Balıkesir
Ali ORAL, *alioral@balikesir.edu.tr,* BAÜ. Makina Mühendisliği Bölümü,10145-Balıkesir
M.Cemal ÇAKIR, *cemal@uludag.edu.tr* , UÜ.Makina Mühendisliği Bölümü,16059-Bursa

ÖZET

Günümüzde yayların birçok kullanım alanı mevcuttur. Bu alanlardan bir tanesi de kalıplarda, kalıp yayı olarak kullanımlarıdır. Kalıplarda, rijitlikleri daire kesitli yaylara göre yüksek olan dikdörtgen kesitli yaylar tercih edilmektedir. Ancak dikdörtgen kesitli yayların üretimlerinin zor ve maliyetli olması nedeniyle bu yayların yerine daire kesitli yayların kullanılabilirliği düşünülmüştür. Daire kesitli yayların üretimi dikdörtgen kesitli yaylara göre kolay ve maliyet bakımından da dikdörtgen kesitli yaylardan daha ekonomiktir. Bu çalışmanın amacı; uygulamada kalıp yayı olarak tercih edilen dikdörtgen kesitli yayların yerine, daire kesitli yayların kullanılabilirliğinin deneysel olarak değerlendirilmesidir. Bu çalışmada, aynı koşullar altında hem dikdörtgen kesitli yaylar hem de daire kesitli yaylar yorulma testlerine tabi tutulmuş ve elde edilen sonuçlar sunulmuştur.

Anahtar Kelimeler: Kalıp yayları, yorulma, yay yorma makinesi

ABSTRACT

Springs have been used extensively in many applications. One of these applications is the die springs. In practice, due to their high rigidity, springs with rectangular cross-sections are prefered as die springs rather than circular ones. However, since the production of rectangular springs is diffucult and costly, circular springs need to be taken into consideration as die springs as well. Circular springs are easier to manufacture and they are more economical. The aim of this work is to evaluate the use of circular die springs rather than most prefered, rectangular springs in die and mold making operations. Therefore, experiments have been done, both rectangular and circular springs were subjected to fatique tests and the results were discussed in the present work.

Keywords: Die springs, fatigue, spring fatigue machine

ON YILINI TAMAMLAMIŞ LPG TANKLARININ HASAR ANALİZİ (T07)

Fuat KARTAL *fuatkartal81@hotmail.com* Kastamonu Üniversitesi, 37100, Kastamonu
Arslan KAPTAN *akaptan@gop.edu.tr* Gaziosmanpaşa Üniversitesi,60250, Tokat
Yasin KİŞİOĞLU *ykisioglu@kocaeli.edu.tr* Kocaeli Üniversitesi,41100, Kocaeli

ÖZET

Ülkemizdeki LPG'li araç sayısı 1.500.000'u aşkın olup her geçen gün kullanıcı ve üretici firma sayısı artmaktadır. ECR 67R 01 ve TS 12095 standartlarına göre korozyon etkisi on yıl olan 1,5 milyonu aşkın LPG yakıt tanklarının 300 bininin teknik ömrünü tamamladığı kabul ediliyor ve değiştirilmesi gerekiyor. Teknik ömrünü tamamlamış LPG tankı, kullanılmaya devam edilmesi halinde patlama riski taşıyor. LPG tankları kullanımı sırasında LPG yakıt dolumu ve kullanılarak bitmesi ile iç basınç etkisi altında yorulmaya maruz kalmaktadır. Ayrıca çevre şartları, nem, sarsıntı, korozyon, çizilme vb. gibi dış etkenlerin olumsuz etkisi altında çalışmaktadır. Bu çalışmada, teknik ömrünü tamamlayan ve değiştirilen LPG yakıt tanklarının mekanik ve makro grafik hasar analizi yapılmış olup kullanılmamış tank değerleri ile karşılaştırılması yapılmıştır.

Anahtar kelimeler: Taşıt LPG Tankı, LPG Tank Ömrü, Hasar Analizi,

ABSTRACT

LPG vehicles 1,500,000 in our country 'u love every day and is increasing the number of users and manufacturers. ECR 67R 01 and TS according to the corrosion effect on the standard 12095th year that more than 1.5 million LPG fuel tank of the technical life of 300 thousand that is considered complete and must be changed. LPG tank has completed the technical life, continue to be used in case of explosion risk brings. LPG fuel tanks during the use of LPG filling and using a bit under the influence of internal pressure with the tire is being exposed. In addition, environmental conditions, humidity, vibration, corrosion, scratches, etc.. under the influence of external factors such as negative works. In this study, the technical life cycle and change the mechanics of the LPG fuel tank and damage analysis macro graphics were made for unused tanks and comparison is made.

Keywords: Vehicle LPG Tanks, LPG Tanks Life, Failure Analysis

AISI 304 PASLANMAZ ÇELİKLERİN İŞLENEBİLİRLİĞİNİN YAPAY SİNİR AĞLARI METODU İLE MODELLENMESİ (T13)

Murat OK, *muratok@duzce.edu.tr*, Düzce Üniversitesi, Düzce
Ali ÜNÜVAR, *aunuvar@selcuk.edu.tr*, Selçuk Üniversitesi, 42075, Konya
A.Serhat ERSOYOĞLU,*aersoy@selcuk.edu.tr*, Selçuk Üniversitesi, 42075, Konya

ÖZET

Bu çalışmada AISI 304 kalite paslanmaz çelik malzemelerin çok katmanlı karbür uçlu parmak freze çakıları ile frezelenmesi işlenmesinde takım ömrü ve yüzey pürüzlülüğü üzerine kesme parametrelerin etkileri deneysel olarak incelenmiştir. Aynı zamanda AISI 304 paslanmaz çeliklerin işlenebilirliği için tahmin modeli geliştirilmiştir. Bu modelde iş parçası yüzey pürüzlülüğü ve takım ömrünü tahmin etmek için yapay sinir ağları metodu kullanılmıştır.

Anahtar kelimeler: AISI 304, Frezeleme, İşlenebilirlik, Yapay Sinir Ağları

ABSTRACT

In this study, effects of cutting parameters on the surface roughness and tool life were investigated during the milling of AISI 304 materials with multi-layer carbide end mills. Also a predictive model to determine the AISI 304 stainless steel machinability was developed. In this model, artificial neural networks method was used to estimate the workpiece surface roughness and tool life.

Keywords: AISI 304, Milling, Machinability, Neural networks

YÜKSEK BASINÇLI KOMPOZİT HİDROJEN TÜPLERİNİN ÜRETİMİNİN İNCELENMESİ (T19)

Oktay ALNIAK, *oalniak@bahcesehir.edu.tr* Bahçeşehir Üniv. Fen Bilimleri Enst., MYO. Şişli, İstanbul, TÜRKİYE
Ahmet OĞUR, *ogur@sakarya.edu.tr* Sakarya Üniversitesi Makina Mühendisliği Bölümü, Sakarya, TÜRKİYE
Mustafa ERTÜRK, *m.erturk@elimsangroup.com* Elimsan Metalurji ve Makine San. A.Ş., Kocaeli, TÜRKİYE
Çetin KARAKAYA, *ckarakaya@sakarya.edu.tr* Sakarya Üniversitesi Karasu MYO Makine Bölümü, Sakarya, TÜRKİYE

ÖZET

Bu çalışma, Sanayi ve Ticaret Bakanlığı Sanayi Ar-Ge Genel Müdürlüğü tarafından desteklenen San-tez 123 projesi kapsamında gerçekleştirilen yüksek basınca dayanıklı kompozit hidrojen tüplerinin üretimini içermektedir.

San-tez 123 projesi kapsamında, ilk kez ülkemizde yüksek basınca dayanıklı hidrojen depolama tankları ile ilgili ar-ge çalışmaları yapılmış ve prototipler üretilmiştir. Bu çalışmada, tankların imalatında kullanılan 6000 serisi Al Mg Si alaşımı olan 6061, 6063 ve 6082 malzemelerden üretilen tüplerin davranışları incelenmiştir. Tüplerin sağlaması gereken kalite kriterleri ile ilgili incelemelerde bulunulmuştur.

Anahtar Kelimeler: 6061, 6063, 6081 Al Mg Si alaşımları, yüksek basınça dayanıklı hidrojen depolama tankları, hidrojen tanklarının sonlu elemanlar metodu ile analizleri

ABSTRACT

This study includes production of high pressure resistant composite hydrogen tubes supported by R & D General Management of Ministry of Industry within the context of San-tez 123 Project.

In the context of San-tez 123 Project, for the first time in our country, R & D activities were conducted and prototypes were produced for high pressure resistant storage tanks for hydrogen. In this study, behaviors of 6061, 6063 and 6082 alloys of the 6000 Al series have been investigated under high pressures which are used in manufacture of tanks. Observations have been made for the quality criteria that tubes should provide.

Key Words: 6061, 6063, 6081 Al Mg Si alloys, high-pressure hydrogen storage tanks, hydrogen storage, high-pressure tank, finite element method analysis of the hydrogen tanks

BORLANMIŞ AISI 4140 ÇELİĞİNDE BORÜR TABAKA KALINLIĞININ KOROZYON DAYANIMINA ETKİSİNİN YAPAY SİNİR AĞLARI İLE TAHMİNİ (T20)

Salim ŞAHİN, *salim.sahin@bayar.edu.tr*, Celal Bayar Üniversitesi, 45140, Manisa
Hülya KAÇAR, *hulya.kacar@bayar.edu.tr*, Celal Bayar Üniversitesi, 45400, Manisa
Filiz TAŞTAN, *filiz.tastan@bayar.edu.tr*, Celal Bayar Üniversitesi, 45140, Manisa

ÖZET

Bu çalışmanın amacı, farklı süre ve sıcaklıklarda borlanmış AISI 4140 çeliğinin korozyon dayanımının yapay sinir ağları ile modellenmesidir. Model oluşumu işleminde girdi parametreleri olarak borlama süresi (2 ve 4 saat), borlama sıcaklığı (860 ve 900 ^{o}C) ve tabaka kalınlıkları (0, 18, 48, 62 ve 104 μm) kullanılmıştır. Hataların beslenmesi ise geriye yayılım algoritması ile gerçekleştirilmiştir. 5000 iterasyonla optimal sonuçlara ulaşılmış ve ortalama hata % 1.77 dir. Borlanmış AISI 4140 çeliğinin bazı özelliklerini kullanarak yapılan modellemeyle başarılı bir şekilde elde edilen korozyon dayanımı değerleri; yüzey sertleştirme işlemlerinin bazı sonuçlarının tahmininde yapay sinir ağlarının çok kullanışlı araçlar olduğunu göstermiştir.

Anahtar Kelimeler: AISI 4140, Borlama, Yapay sinir ağları.

ABSTRACT

Aim of the study is modelling by ANN of corrosion strength of AISI 4140 boronized at the different times and temperatures. In ANN model, input parameters are boronizing time (2 and 4 h), boronizing temperature (860 and 900 ^{o}C) and boron layer thickness (0,18, 48, 62 and 104 μm). Transfer function is sigmoid function. Optimum results were obtained with 5000 iteration. Error% was obtained 1.77% modelling with ANN of boronized AISI 4140, corrosion strength values were obtained succesfully. ANN is tool useful for engineering materials and surface.

Keywords: AISI 4140, Boronizing, Artificial Neural Network.

BİR ÇİFT SOLENOİDLİ DOĞRUSAL TAHRİK SİSTEMİNİN KONUM ANALİZİ, KONTROL TASARIMI VE DENENMESİ (T09)

İlhami YİĞİT , *ilhami.yigit@bozok.edu.tr* , Bozok Üniversitesi Müh. Mim. Fakültesi, Yozgat

ÖZET

Bu çalışmada, çift solenoidli uzun stroklu bir doğrusal tahrik sisteminin geliştirilmesi için modelleme, bilgisayarlı konum kontrolü, performans deneyleri ve değerlendirilmesi ele alınmaktadır. Çok yaygın kullanımı olan solenoid tahrik elemanları basit yapılarına rağmen son derece doğrusal olmayan davranış gösteren ve doğrusal olmayan girişe sahip elemanlardır. Solenoid bobininin endüktansı nüvesinin konumu ile değiştiğinden ve oluşan manyetik kuvvet uygulanan akımın karesiyle doğru orantılı olduğundan bozucu girişlerin sistem çıkışı üzerindeki etkileri de bulunulan konuma göre hayli değişiklik göstermektedir. Solenoidler akım girişindeki ufak bir değişikliğe bile çok duyarlı olduklarından dolayı yüksek doğrulukta kontrolleri çok düşük örnekleme zamanlarını gerektirmektedir. Çift solenoid tahrikli gerçek bir sistemin modellenmesi ve konum kontrolünün teorik ve deneysel açılardan ayrıntılı olarak ele alınması amacıyla bu çalışma yapılmıştır. Solenoid nüvesinin konumu sistemin dinamiğini etkilememek amacıyla lazerli konum ölçer kullanılarak ölçülüp bilgisayara geribeslenmiştir. Geliştirilen görsel kontrol yazılımı ile değişik kontrol teknikleri kullanılarak elde edilen kontrol sinyali bir servo yükseltici üzerinden solenoidlere uygulanmıştır. Yukarıda anılan doğrusal olmayan özellikler plant benzetimlerinde de gözlenmiş, solenoid tahrik elemanı konum kontrol sisteminin tasarımında dikkate alınmıştır. Çalışmada çok sayıda performans deneyi yapılmış, sonuçları irdelenmiş, uzun stroklu solenoid tahrik sistemlerinin tasarlanması çalışmalarında yararlanılabilecek önerilerde bulunulmuştur.

Anahtar Sözcükler : çift solenoidli tahrik elemanı, modelleme, konum kontrolü, bilgisayarlı kontrol

ABSTRACT

Inverted pendulum systems are excellent experimental platforms which exhibit highly nonlinear, coupled, and unstable dynamic behaviour. Therefore, they exist in most control laboratories for educational purposes and research studies such as testing a new developed control algorithm and

comparing it with older ones. In this study, modeling, design, construction and pulse width modulated sliding mode control of a computer controlled cart-type inverted pendulum were dealth with in detail. Angular position of the pendulum was measured and fed backed and recorded by means of a computer. PID and sliding mode control were used for a later comparison before applying pulse width modulated sliding mode control. Control signals were obtained in a visual control software developed for this purpose and transmitted to a servo amplifier and a servomotor to stabilize the pendulum. Several performance tests were implemented in order to show the efficiency of the utilized control techniques and overall performance of the pendulum system developed. Satisfactory results were obtained with pulse width modulated sliding mode control.

Keywords: Cart type inverted pendulum, sliding mode control, pulse width modulation, modeling

500 TONLUK DEFORMASYON HIZI KONTROLLÜ ELEKTROHİDROLİK TAHRİKLİ BİR BETON BASMA DENEYİ MAKİNASININ TASARIMI (T10)

İlhami YİĞİT , *ilhami.yigit@bozok.edu.tr* , Bozok Üniversitesi Müh. Mim. Fakültesi, Yozgat

ÖZET

Günümüzde beton deneylerinin deformasyon hızı kontrollü bir deney makinasında yapılması,
özellikle depreme dayanıklı beton geliştirme çalışmalarında sünekliğin ve tokluğun hassas bir şekilde belirlenebilmesi açısından kaçınılmaz hale gelmiş bulunmaktadır. Buna bağlı olarak, beton deneyleri için bilgisayar kontrollü, elektrohidrolik tahrikli bir beton basma deneyi makinası tasarlandı. Betonun yapmış olduğu deformasyon hassas bir uzama ölçer ile ölçülüp geri beslenmekte deformasyon hızı kontrolü gerçekleştirilmektedir. Ayrıca beton basma deneyinde numuneye uygulanan yük, hidrolik pistonunun konumu, numunede oluşan deformasyon, hidrolik silindirdeki basınç, servovalfe giden akım ölçülerek bilgisayara kaydedilmektedir. Geliştirilen kontrol yazılımı ile değişik kontrol teknikleri uygulanarak elde edilen kontrol sinyali bir servo yükselticiye ve servovalfe iletilerek deformasyon hızı kontrolü gerçekleştirmektedir. Kontrol yazılımı deney sırasında yük-deformasyon eğrisini çizebilmekte, tüm ölçüm sinyallerini kaydedebilmekte ve deney raporu verebilmektedir. Geliştirilen deney makinası beton küp ve silindirik numunelerin basma deneylerinin yanı sıra, jeolojik çalışmalarda taş numunelerin basma deneyini de yapabilecek özelliktedir. Deney düzeneği şeklinde 120 tonluk bir prototip imal edilerek makinanın kontrol sistemi ve yazılımı geliştirilmiştir. Elde edilen deneyimler ışığında, 500 tonluk basma deneyi makinanın tasarımında iyileştirici düzenlemeler yapılmıştır. Bu bildiride bilgisayar kontrollü bir 500 tonluk deformasyon hızı kontrollü basma deneyi makinasının yalnızca tasarımı ele alınmaktadır.

Anahtar Kelimeler: basma deneyi makinası, deformasyon hızı kontrolü, beton basma deneyi, modelleme, elektrohidrolik kontrol, bilgisayarlı kontrol

ABSTRACT

It has become unavoidable to use a deformation rate controlled testing machines in determination of the ductility and the toughness of the concrete accurately, especially in developing high strenght concrete resisted to earthquakes. From this view of point, a computer controlled and electrohydraulically driven deformation rate controlled compression testing machine was designed. Deformation rate control was implemented by measuring and feedbacking the deformation of a concrete specimen. Load applied to the specimen, position of the hydraulic piston, deformation of the specimen, pressure in the hydraulic cylinder and electrical current to a servovalve was measured and recorded by means of a computer. The control signals was obtained by using various control techniques in a visual control software developed for this purpose and transmitted to a servo amplifier and a servovalve in order to realize the deflection rate control. The control software is capable of drawing the load - deformation curve, recording all the measurement signals and ploting these variables versus time graph and giving test reports. In addition to compression tests of concrete specimens, the compression testing machine is capable of testing rock specimens for geolojical studies. A prototype of 120 tonne as a setup was produced, control system and software was developed. With this experience, modifications were done on the design of a 500 tonne compression testing machine. In this paper, only the design of a 500 tonne deformation controlled electrohydraulically driven compression testing machine is dealt with.

Keywords: compression testing machine, deformation rate control, concrete compression test, modeling, electrohydraulic control, computer control

AUTHORS INDEX