

# **22nd Canadian Congress of Applied Mechanics 2009**

**(CANCAM 2009)**

**Halifax, Nova Scotia, Canada  
31 May – 4 June 2009**

ISBN: 978-1-61567-398-8

**Printed from e-media with permission by:**

Curran Associates, Inc.  
57 Morehouse Lane  
Red Hook, NY 12571  
[www.proceedings.com](http://www.proceedings.com)

**Some format issues inherent in the e-media version may also appear in this print version.**

Copyright© (2009) by Dalhousie University/Mechanical Engineering  
All rights reserved.

Printed by Curran Associates, Inc. (2009)

For permission requests, please contact Dalhousie University/Mechanical Engineering  
at the address below.

Dalhousie University  
Mechanical Engineering C360  
PO Box 1000  
Halifax NS B3J 2X4 Canada

Phone: (902) 494-3917  
Fax: (902) 423-6711

[mechanical.engineering@dal.ca](mailto:mechanical.engineering@dal.ca)

<b>SESSION: 1.1.M.1: Computational Mechanics</b>	<b>1</b>
Preliminary Fatigue Analysis of Vessel-Nozzle Intersections with Local Thinned Areas <i>M.Qadir, D. Redekop</i>	2
Stress Analysis of Tee Intersections with Tapered Inner-Wall Thinning at the Junction <i>M. Qadir, D. Redekop</i>	4
Stress Concentration in a Pressurized Ovaloid Toroidal Tank with a Nozzle <i>H. J. Zhan, D. Redekop</i>	6
Numerical Optimization of the Method of Cooling of a Massive Casting of Ductile Cast-Iron <i>F.Kavicka, B.Sekanina, J.Stetina, K. Stransky, J.Dobrovska</i>	8
A Nodal Position Finite Element Method for Plane Elastic Problems <i>Z.H. Zhu, B. H. Pour</i>	10
Numerical Simulation of Convective Heat Transfer in a Continuous Paint Cure Oven <i>A. Ashrafzadeh, R. Mehdipour and M. Rezvani</i>	12
<b>SESSION: 2.1.M.2 Symposium: Design and Analysis</b>	<b>14</b>
Numerical Study of the Fundamental Lamb Waves Interaction with a Symmetrical Abrupt Reduction of Plate Thickness <i>J. Mirahmadi, and F. Honarvar</i>	15
Optimization of a Concasting Technology of a Steel Slab via Numerical Models <i>J. Stetina, F. Kavicka, B. Sekanina, J. Dobrovska</i>	17
Development of an MDO Platform for Aircraft Conceptual Design <i>D. Neufeld, K. Behdinan, J. Chung</i>	19
Carbon Emissions Calculations in Design for Environment <i>P. Nava, J. Jeswiet, I. Y. Kim</i>	21
Generating Optimal Structural Topology using Design Space Optimization <i>Chris Boyle, Il Yong Kim</i>	23
Automatic Partitioning of Unstructured Finite Element Meshes Using a Genetic Algorithm <i>Jirasek, L. &amp; Behdinan K</i>	25
<b>SESSION: 3.1.M.3 Thermo Fluids</b>	<b>27</b>
Design analysis and comparison between standard and rotary porting systems for IC engine <i>R. Palmisano and H.D. Ng</i>	28
Synchronization in Kelvin Equilibria <i>H. Ait Abderrahmane, K. Siddiqui, and G.H. Vatistas</i>	30
Numerical Estimation of Fluidelastic Instability in Normal Triangle Tube Arrays <i>H. Omar, M. Hassan, &amp; A. Gerber</i>	32

Potentiel d'un système hybride éolien-diesel-air comprimé pour une station télécom isolée (Partie I) <i>H. Ibrahim,, H. Chabour, M.Dimitrova,, A.Ilinca, J. Perron</i>	34
Potentiel d'un système hybride éolien-diesel-air comprimé pour une station télécom isolée (Partie II) <i>H. Ibrahim,, H. Chabour, M.Dimitrova,, A.Ilinca, J. Perron</i>	36
Simulation of the Temperature Distribution in a Directly-Irradiated Solar Chemical Reactor <i>M. Nabavi, K. Siddiqui , H.D. Ng</i>	38
<b>SESSION: 4.1.A1.1 Mechanics of Solids and Structures</b>	<b>40</b>
Identification of Crack in Timoshenko Beams Using Frequency Data <i>P. Razi, S. Moradi, L. Fatahi</i>	41
How to Avoid Futile Finite Element Analysis of Singular Stresses <i>G.B. Sinclair, J.R. Beisheim, J.E.Helms and S.Sezer</i>	43
Compression of rubber disks between frictional surfaces <i>A. N. Gent, F. M. Discenzo, J. B. Suh</i>	45
Fatigue life of drilling bit bearings under arbitrary random loads <i>M. Talimi, R. Farshidi</i>	47
ARX Model for Gear Fault Detection using Varying Load Information <i>Ming Yang, Viliam Makis , Wolfe Dan</i>	49
Reducing Stress Shielding: FEA of Orthopaedic Screws <i>K. Haase, G. Rouhi</i>	51
<b>SESSION: 5.1.A1.2 Dynamics and Kinematics</b>	<b>53</b>
Stability Analysis of Bipedal Standing via Lyapunov Exponents Calculated from a Time Series Using Nonlinear Mapping <i>C. Yang, Q. Wu</i>	54
Optimal Stabilization of Biped Standing with Neural Network <i>X. Wang, C. Yang and Q. Wu</i>	56
Simulating Flows Past Cylinders on the b-plane <i>D. Steinmoeller, S.J.D. D'Alessio, F.J. Poulin</i>	58
Designing a Tensioning Mechanism for a Belt-driven Integrated Starter-generator System <i>Adebukola O. Olatunde, Jean W. Zu</i>	60
Aircraft Tracking Using a Radar and the Variable Structure Filter <i>S. A. Gadsden , S. R. Habibi</i>	62
Generation of an Accelerated Testing Driven Profile for Shaker <i>C. Yang, Q. Wu</i>	64

<b>SESSION: 6.1.A1.3 Symposium: Advanced Composites</b>	<b>66</b>
Effect of Thermal Cyclic Loading on Aluminum-Glass Fiber Reinforced Composite Interface <i>Kaveh Arjomandi, Sarah Baftchi and Farid Taheri</i>	67
Development of Asbestos Free Composites for Solid Rocket Motor Insulation <i>Ashraf Fathy Ahmed and Suong V. Hoa</i>	69
A Comparison of Pulsed Thermography and Ultrasonic C-scanning for Inspection of Aircraft Composite Structures <i>A Fahr, M. Genest, M. Brothers and R. Rutledge</i>	71
Updating the FE Model of a Z-shaped Pipeline by Experimental Modal Data <i>L. Fatahi, S. Moradi , P. Razi</i>	73
Buckling Analysis of Flat Tapered Composite Plates Using Ritz Method Based on First-order Shear Deformation Theory <i>S. Akhlaque-E-Rasul, R. Ganesan</i>	75
Nonlinear Vibrations of Delaminated Beam-Plate by the Differential Quadrature Method <i>Ramadan A. Esmaeel, M. M. Nassar , A. A. Mahmoud</i>	77
Influence of Combined Loading state on FRP Repaired Steel Pipelines <i>Ahmed Shouman and Farid Taheri</i>	79
<b>SESSION: 7.1.A1.4 Thermo Fluids</b>	<b>81</b>
Numerical Simulation of a Flow over a Cylinder inside a Channel Using an Immersed Boundary Method and Physical Virtual Model <i>D. G. S. D. R. Vieira, S. S. Mansur , J. Militzer</i>	82
RANS Calculations of Propeller Tip Vortices <i>David Hally</i>	84
Predicting hydrodynamic sound <i>S. Murphy, J. Militzer , M. Seto</i>	86
Turbulent convective heat transfer of very dilute Al <sub>2</sub> O <sub>3</sub> /water nanofluid inside a circular tube <i>S.M. Fotokian, M. Nasr Esfahany</i>	88
Numerical investigation on free convection heat transfer from an isothermal horizontal cylinder located above an adiabatic horizontal surface <i>T. Yousefi, S. Yazdani, S. Bigham</i>	90
Effect of aspect ratio and Rayleigh number on natural convection heat transfer from an isothermal horizontal cylinder located underneath an adiabatic ceiling <i>T. Yousefi, S. Bigham , S. Yazdani</i>	92
<b>SESSION: 8.1.A2.1 Energy Efficiency in the Residential Sector</b>	<b>94</b>
Sustainable Archetype Housing Monitoring Project at Kortright Centre <i>D. Zhang, R. Barua and A.S. Fung</i>	95

Analysis of Different Mechanical Systems for Ontario Housing Market Using Hot2000 and RETScreen <i>Alan Fung , Ka Long Ringo Ng , Farzin M. Rad, and Humphrey Tse</i>	97
Summary of Detailed Energy Audit and Building Simulation on Archetype Sustainable House, Woodbridge ON <i>Alan Fung, Aya Dembo and Jack Zhou</i>	99
<b>SESSION: 9.1.A2.2 Education</b>	<b>101</b>
Application of Working Model 2D in Teaching of Dynamics: Practical Experience <i>J. Uziak</i>	102
Virtual Motorsports In Project-Based Engineering Education <i>R.J. Rieveley, B.P. Mianaker</i>	104
Mech 2: A Collaborative Mechanical Engineering Curriculum for the 21st Century <i>P.M. Ostafichuk , E.A. Croft , G.S. Schajer , and S.I. Green</i>	106
<b>SESSION: 10.1.A2.3 Emerging Fields</b>	<b>108</b>
Effect of a substrate on the electrostatics of a charged particle or polyelectrolyte in electrolyte solution <i>O. Malysheva , T. Tang , P. Schiavone</i>	109
The Future of Automobiles: Cognitive Cars <i>S. A. Gadsden , S. R. Habibi</i>	111
Ranking Oil Sands Bitumen Recovery Techniques <i>A. Lam, D.S. Nobes, M.G. Lipsett</i>	113
Noise Prediction for Motorsport Events Using Geomatics Technology <i>A.K. Mitchell</i>	115
<b>SESSION: 11.1.A2.4 Thermo Fluids</b>	<b>117</b>
Design of an Experimental Apparatus for Determining the Effects of Acoustic Stimulation on the Rheological Properties of Oils and Multi-Phase Fluids <i>Marc D. Evans, David S. Nobes , Michael G. Lipsett</i>	118
Numerical analysis of the effect of injection on the turbulent mixing quality in a simple combustor <i>Miguel Alejandro Gutiérrez Contreras, Ali Dolatabadi and Hoi Dick Ng</i>	120
The Impact of Aperture Size on the Thermal Performance of a Parabolic-Dish Concentrated Solar Energy System <i>M. Wang, K. Siddiqui</i>	122
Numerical Calculation of Fluid Induced Forces in Shell-and-Tube Heat Exchangers <i>B. Ghadiri Dehkordi, H. Hourji Jafari</i>	124

**SESSION: 12.2.M.1 Symposium: Vehicle Dynamics and Control I** **126**

Comparative Study of Design Synthesis Approaches for Mechatronic Vehicles with Integrated Control Systems <i>Yuping He</i>	127
Nonlinear Modeling of Flexural Damping of Slacking Wire Cable using Rayleigh Damping Model <i>Z. H. Zhu</i>	129
Design Synthesis of Heavy Articulated Vehicles with Rearward Amplification Control <i>M. M. Islam, Y. He</i>	131
Dynamic Stability Predictions for an Unmanned Vehicle with Varying Center of Gravity <i>B.Beckman, J. Pieper, D. Mackay and M. Trentini</i>	133
Mechatronic Modelling and Real-time Simulation of an Electric Vehicle with In-wheel Motors <i>H. Vogt , C. Schmitke , K. Jalali , J. McPhee</i>	135
Automatic Generation of the Equations of Motion for Vehicle Stability Analysis <i>B.P. Minaker, R.J. Rieveley</i>	137

**SESSION: 13.2.M.2 Thermo Fluids** **139**

The effect of the presence of higher background turbulence on smooth open-channel flow <i>M.A.A. Faruque, Bushra Afzal , Scott Wolcott , Ram Balachandar</i>	140
Theoretical Study on Thermoacoustic Couples <i>Hadi Babaei, Kamran Siddiqui</i>	142
A New Approach for Scalar Diffusion in a Turbulent Flow <i>P. Sarathi, R. Gurka, P. J. Sullivan, G. A. Kopp</i>	144
Comparison of turbulent models with the S809 airfoil <i>T. Tardif d'Hamonville, A. Ilinca</i>	146
Numerical and Experimental Studies on Polymeric Liquids <i>A. Guaily, E. Cheluget , K. Lee, M. Epstein</i>	148
Finite Element Method for the Compressible Maxwell Fluids <i>A. Guaily, M. Epstein</i>	150
Design of Continuous Radiation Ovens Using a Gradient-Based Optimization Method <i>R. Mehdipour , A.Ashrafizadeh C.Aghanajafi</i>	152

**SESSION: 14.2.M.3 Mechanics of Solids and Structures** **154**

Nondestructive Evaluation of Stress using Ultrasonic Leaky Lamb Waves <i>M. Post, Z.H. Zhu, S.A. Meguid</i>	155
Design and Fabrication of a Micromachined High Sensitivity Capacitive Sensor <i>Hamed Farahani, James K. Mills, William L. Cleghorn</i>	157

Study of a Transversal Crack in a Steel Slab from the Chemical Heterogeneity Point of View <i>J. Dobrowska, F. Kavicka , K. Stransky, J. Stetina</i>	159
Wavelet Analysis — Based Gear Shaft Fault Detection Using Vibration Data <i>J. Yu, V. Makis</i>	161
SSI-based Modal Characterization of Micron-scale Structures <i>P. Hafeez, J. M. Book, S. F. Asokanthan</i>	163
Design of an Improved Ice Hockey Stick Test Machine <i>E. Genoud , J. McPhee</i>	165
<b>SESSION: 15.2.A1.1 Dynamics and Kinematics</b>	<b>167</b>
Nonlinear periodic response of large dynamical systems <i>S.M. Ibrahim, B.P. Patel, Y. Nath</i>	168
Dynamics of railway vehicle system moving on tangent tracks <i>C.L.N.S. Rao, S.M. Ibrahim, B.P. Patel, Y. Nath</i>	170
Dynamic analysis of bimodulus laminated angle-ply conical panel <i>K.Khan, B.P.Patel, Y.Nath</i>	172
An Experimental Investigation of Vortex-Shedding from Yawed Circular Cylinders <i>James D.Hogan, Joseph W. Hall</i>	174
Frequency Domain Analysis of Dynamic Wave-Induced Forces During Ship Towing <i>K. McTaggart</i>	176
On FE simulation of the pendulum oscillations controlled by a moving mass <i>E. Sharbati, W. Szyszkowski</i>	178
<b>SESSION: 16.2.A1.2 Thermo Fluids</b>	<b>180</b>
Simulation of Low-Reynolds Number Flow around a Square Cylinder Using Multiple-Relaxation- Time Lattice Boltzman Method (LBM) <i>S. Jafari , M. Salmanzade , M. Rahnama and G. Ahmadi</i>	181
A Small Multi-Phase Flow Loop used in Training a Neural Network Algorithm for Density Measurements <i>Al-Rawahi, M. Meribout , A. Al-Naamany , A. Al-Bemani , A. Meribout</i>	183
An experimental Investigation of the Reynolds stress distribution over wind generated water waves <i>N. Shaikh, Kamran Siddiqui</i>	185
Traitement thermique du bois à haute température : Simulation et validation expérimentale <i>R. Younsi, D. Kocaeffe, S. Poncsak, Y. Kocaeffe &amp; L. Gastonguay</i>	187
Updating the FE Model of a Z-shaped Pipeline by Experimental Modal Data <i>L. Fatahi, S. Moradi , P. Razi</i>	189
Spray Cooling of a Heated Surface by Saturated and Subcooled Water <i>Christopher Cho and R. Ponzel</i>	191



**SESSION: 17.2.A1.3 Mechanics of Solids and Structures** **193**

Multiscale modeling and optimization of gastropod shells  
*M. Yourdkhani, F. Barthelat, D. Pasini* 194

One-Step Calculation of Translational and Rotational Kinetic Energy Stored in a Rolling Body as a Result of an Impulsive Force  
*A. Peter M. Osterberg, B. Aziz S. Inan* 196

The Effects of Surface Elasticity on an Elastic Solid with Mode-III Crack  
*C.I. Kim, P. Schiavone, C-Q. Ru* 198

A Modified Co-rotational Formulation for Beam Element in Large Deflection Analysis  
*Y. Liu, N. Rattanawangcharoen, J. Kell* 200

Momentum Wins Adhesion Forces at the Micrometer Scale  
*B.K. Chen, Y. Zhang, and Y. Sun* 202

**SESSION: 18.2.A1.4 Symposium: Vehicle Dynamics and Control II** **204**

The Design of a Digital Vehicle for use in a Student Virtual Race  
*M. Johnston, B. Minaker* 205

Development of Intersatellite Separation System for Nanosatellite Formation-flying Mission  
*B. Larouche, R. E. Zee, Z. H. Zhu* 207

A Reconfigurable USAR Robot Designed for Traversing Complex 3D Terrain  
*K. Davies, A. Ramirez-Serrano* 209

Harbour Sentry - A Platform to Enhance Diver Detection  
*M. Seto, D. Hopkin, R. Bauer, C. Davis, A. Oad, J. David, E. Pereira, G. Bartlett* 211

Development of Autonomous Agents for Mine Counter Measures  
*Warren Connors, Vincent Myers, Mae Seto* 213

**SESSION: 19.2.A2.1 Advanced Materials** **215**

Asymptotic homogenization of smart composite materials & structures  
*Alex Kalamkarov* 216

Ply Angle Orientations for Fabrication of Composite Tubes  
*G. Milburn, G. Akhras, M.J. Potvin* 218

Determination of Young's Modulus and Tensile Strength of Viscoelastic Polymers at High Strain Rates  
*B. Möglinger, S.R. Raisch* 220

Modeling the negative Poisson's ratio of compressed fibrous networks  
*Mehmet S. Tatlier, Dr. Lesley M. Berhan* 222

Negative Thermal Expansion Materials: Thermal Stress and Implications for Composite Materials  
*Michael B. Jakubinek, Catherine A. Whitman, Mary Anne White* 223

**SESSION: 20.2.A2.2 Biomechanics** **225**

An Alternative Approach to Better Predict Injury Mechanisms to the ACL during Non-contact Events  
*Nicholas Ali, Adey Farah* 226

Finite element analysis of cam-type femoroacetabular impingement: comparing stress and strain energy density distributions for a healthy control femur versus an impinged femur  
*K.C. Geoffrey Ng, Gholamreza Rouhi, Mario Lamontagne, Paul Beaulé* 228

Investigation of Vibration Characteristics and Intraocular Pressure of Eyes  
*R. Farshidi, S. Salimi, S.S. Park, T. Freiheit* 230

Influence of Biomechanical Properties on Intraocular Pressure  
*S. Salimi, T. Freiheit, S.S. Park, R. Farshidi* 232

**SESSION: 21.2.A2.3 Thermo Fluids** **234**

Dynamic Modeling of Two-Phase Helium Pipe Flow  
*C. Regier, J. Pieper, E. Matias* 235

Cold-Gas Thruster Development for Hardware-in-the-Loop (HITL) Simulation  
*Piotr Wenderski, Jinjun Shan* 237

Particle-based approach to numerical simulation of Stenotic Flows  
*K. Rohlf* 239

The development of an experimental facility for the Three-Dimensional Wall Jet  
*Lhendup Namgyal, Joseph W Hall* 241

**SESSION: 22.3.M.1 Mechanics of Solids and Structures** **243**

Fracture Behavior of Interacting Cracks in Functionally Graded Piezoelectric Materials (FGPMs)  
*Z. Yan, L. Y. Jiang* 244

Further Stability Analysis of Toroidal Shells using Differential Quadrature  
*X.H. Wang, D. Redekop* 246

Model Reference Adaptive Control of a Three DOF Garment Hanger  
*E. H. K. Fung, Y.K. Wong, C. W. M. Yuen, W. K. Wong* 248

Chemorheology and Yield Behavior of Nickel-filled Conductive Epoxy Adhesives during Processing and Cure  
*Jianguo Zhou, Erol Sancaktar* 250

Experiments and Modeling of Magnetic Shape Memory Alloys  
*Heidi P. Feigenbaum, Constantin Ciocanel* 252

A Simple Model for Directional Distortional Hardening in Metal Plasticity with a Convex Yield Surface  
*Heidi P. Feigenbaum, Jiri Plešek, Yannis F. Dafalias* 254

<b>SESSION: 23.3.M.2 Advanced Materials</b>	<b>256</b>
Ultrasonic Detection of Fibre Orientation in Fibre-Reinforced Composites <i>M. Post, Z.H. Zhu, G. Clarkson</i>	257
Hardness Mapping: A useful Tool <i>R.B.T. Price, B.M. Allain C.M. Felix</i>	259
Study of Structural and Chemical Heterogeneity of IN 738LC Nickel Based Superalloy in Dependence on Cooling Rate of Solidification <i>J. Dobrowska, S. Zla, V. Vodarek, F. Kavicka</i>	261
Solution axisymétrique pour un milieu semi-infini cubique <i>M. Dahan</i>	263
Micromechanical Properties of TiNi Shape Memory Alloy <i>C. Zhang and Z. Farhat</i>	265
Effect of a substrate on the electrostatics of a charged particle or polyelectrolyte in electrolyte solution <i>O. Malysheva , T. Tang , P. Schiavone</i>	267
<b>SESSION: 24.3.M.3 Thermo Fluids</b>	<b>269</b>
Decentralized Energy Planning for Renewable Energy Sources <i>A. Ozpinar, E. Ozil , V.I. Ugursal</i>	270
Pressure/Stress Singularities for Viscous Flows <i>G.B. Sinclair, X Chi and T.I-P. Shih</i>	272
Thermal Storage in a Cylindrical Container: Heat Transfer Rate Optimization Using Fin <i>W. Ogoh, D. Groulx</i>	274
Lattice Boltzmann Simulations of Microscopic Blood Flows: Cell Free Layer Development and Cellular Property Effects <i>Junfeng Zhang, Paul C. Johnson, and Aleksander S. Popel</i>	276
Experimental prediction of wind turbine performance through velocity measurements <i>D. Gertz, D. Johnson</i>	278
<b>SESSION: 25.3.M.4 Thermo Fluids</b>	<b>280</b>
Electrokinetic Pumping Considering Slip Irreversibility for Cooling Electronic Chips <i>E. O. B. Ogedengbe, M. A. Rosen</i>	281
Study of the Effect of Inlet Conditions on the Near-Field Structure of an Axisymmetric Jet using Tomographic PIV <i>A.M. Madej, D.S. Nobes</i>	283
Heat Transfer between Over Bed Oil Burner Flame and a Fluidized Bed during Start-up <i>V. Jain, D. Groulx, P. Basu</i>	285
Towards a more efficient supercritical water based gasifier <i>Prabir Basu and Tanuja Bhattacharjee</i>	287

**SESSION: 26.4.M1.1 Manufacturing** **289**

Modeling and prediction of machines tools errors from circular tests  
*M. Slamani, J.R.R. Mayer, M. Balazinski, S. Engin* 290

Mesure sur machine-outil et compensation d'erreur de flexibilité outil-pièce  
*R. Guiassa* 292

Finite Element Simulation of Powder Metallurgy Alloy Compaction  
*D.A. Doman, D.P. Bishop* 294

**SESSION: 27.4.M1.2 Mechanics of Solids and Structures** **296**

Micromechanical Analysis of Smart 3D Grid-Reinforced Orthotropic Composite Structures  
*E.M. Hassan, A.L. Kalamkarov, A.V. Georgiades* 297

Design and Analysis of a MEMS Vibration Sensor for Automotive Applications  
*Joel Rebello, William L. Cleghorn, and James K. Mills* 299

Influence of Non-constant Poisson's Ratio on the Stresses in a FG Pipe  
*Mohsen Mohammadi and Jonh R. Dryden* 301

**SESSION: 28.4.M2.1 Mechanics of Solids and Structures** **303**

Analysis of Heterogeneous Materials by Adaptive Finite Element Method  
*Yunhua Luo and Hongxi Chen* 304

Progressive Collapse Analysis of Frame Structures Based on Energy Criterion  
*Yunhua Luo* 306

Vers un dispositif intégré de détection rapide des défauts de liaison et internes dans les structures  
*Marie-France Barriol Dandine, Dan Necsulescu* 308

Damage and failure of cross-linked rubbers in quasi-static simple extension: modeling and experiments  
*A. Yu. Melnikov and A.I. Leonov* 310

FEM Calculations of Stress Concentration Factors and Weight Functions in Anisotropic Materials  
*Michael Heinzelmann* 312

Analysis of a Circular Opening in Brittle Rock obeying Hoek-Brown Plasticity  
*S. K. Sharan, R. Naznin* 314

**SESSION: 29.4.M2.2 Manufacturing** **316**

High Speed Scratch Testing Apparatus for single Abrasive Grain Cutting  
*D. Anderson, A. Warkentin, R. Bauer* 317

On Tool Performance during Machining Using Different Coolant Strategies  
*L. Pang, I. M. Deiab and H. A. Kishawy* 319

Energy Losses in a Ram Press Machine for Vegetable Oil Expression  
*I.A. Loukanov and J. Uziak* 321

Effect of Single Point Dressing Conditions on Temperatures Generated in Dry Surface Grinding <i>Al-Mokhtar, O. Mohamed, Andrew Warkentin, Robert Bauer</i>	323
Oxley based force model for end milling <i>H.A. Kishawy, L. Pang</i>	325
A Method for Biaxial Dome Stretching of Thermoplastic Tubes at High Temperature <i>M. Elnagmi, M. Bruhis, M. Jain</i>	327
<b>SESSION: 30.4.M2.3 Thermo Fluids</b>	<b>329</b>
Ray-Tracing Analysis of a Two-Stage Solar Concentrator made of two Parabolic Troughs <i>D. Groulx, B. Soonagle</i>	330
Dispersion des charges électriques dans un capteur ionique de débit d'air à temps de transit <i>Marie-France Barriol Dandine et Roger Barriol</i>	332
Optimisation de la géométrie du condenseur et de l'évaporateur d'un cycle de réfrigération <i>Benoit Allen, Louis Gosselin</i>	334
Transient Heat Transfer Modeling of Solid Oxide Fuel Cells <i>C. Ozgur Colpan, Feridun Hamdullahpur, Ibrahim Dincer</i>	336
Measurement of Time-Averaged Turbulent Free Convective Heat Transfer in a Tall <i>M.E. Poulad, D. Naylor</i>	338