3rd Annual Mechanical Engineering Graduate Student Symposium

October 5, 2002

Organized by:

Mechanical Engineering Graduate Council
http://me.engin.umich.edu/Gradcncl/

Sponsored by:

Department of Mechanical Engineering
http://me.engin.umich.edu/

Rackham School of Graduate Studies
http://www.rackham.umich.edu/

Lawrence Livermore National Laboratory
http://www.llnl.gov/

Graduate Council Members and Support:

Alan McGaughhey
Harsha Badarinarayan
Matt Cavalli
Haitham Mahmoud
Nikhil Mudaliar
Ramanan Sankaran

Melissa Chernovsky
Amit Dhingra
Tiffany Miller
Luciana W. da Silva
Kangwon Wayne Lee
Laura Elgas

Advisor:

Professor Jun Ni
Dear Attendees,

Welcome to the Third Annual Mechanical Engineering Graduate Student Symposium at the University of Michigan. The work presented at this event showcases the excellence, originality, and diversity of the research going on in the department by graduate students at all levels. The goals of the symposium are:

- To give current graduate students an opportunity to present their research in a constructive and diverse atmosphere.
- To give new and prospective graduate students an introduction to the research going on in the department.
- To bring together all members of the Mechanical Engineering community in an exciting and thought provoking day.

The nature of the research in the department is constantly evolving, and to meet this growth, a new session on Bio-Engineering has been added this year. The panel discussion will focus on how graduate students can best prepare themselves for finding a job upon completion of their degrees. It is hoped that this portion of the event will be helpful to students at all levels on a variety of career paths.

Feedback to those giving talks and presenting posters is welcome and encouraged! Do not hesitate to ask a question or make a comment to the students who are presenting their research. The sharing of information is an important part of maintaining a strong graduate student community.

Thank you for participating in this year’s event. Enjoy.

Alan McGaughey

### Schedule of Events

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00am - 9:30am</td>
<td>Registration – EECS Atrium</td>
</tr>
<tr>
<td>9:30am - 11:50am</td>
<td>1st Session of Presentations</td>
</tr>
<tr>
<td></td>
<td>Bio-Engineering - EECS 1005</td>
</tr>
<tr>
<td></td>
<td>Design and Manufacturing - EECS 1200</td>
</tr>
<tr>
<td></td>
<td>Dynamics, Systems and Controls – EECS 1301</td>
</tr>
<tr>
<td></td>
<td>Fluid Mechanics, Heat Transfer and</td>
</tr>
<tr>
<td></td>
<td>Combustion – EECS 1001</td>
</tr>
<tr>
<td></td>
<td>Solids Mechanics and Materials – EECS 1003</td>
</tr>
<tr>
<td>12:00pm - 1:00pm</td>
<td>Lunch and Poster Session</td>
</tr>
<tr>
<td></td>
<td>EECS Atrium</td>
</tr>
<tr>
<td>1:00pm - 3:20pm</td>
<td>2nd Session of Presentations</td>
</tr>
<tr>
<td></td>
<td>Bio-Engineering - EECS 1005</td>
</tr>
<tr>
<td></td>
<td>Design and Manufacturing – EECS 1200</td>
</tr>
<tr>
<td></td>
<td>Dynamics, Systems and Controls – EECS 1301</td>
</tr>
<tr>
<td></td>
<td>Fluid Mechanics, Heat Transfer and</td>
</tr>
<tr>
<td></td>
<td>Combustion – EECS 1001</td>
</tr>
<tr>
<td></td>
<td>Solids Mechanics and Materials – EECS 1003</td>
</tr>
<tr>
<td>3:30pm - 4:30pm</td>
<td>Panel Discussion – EECS 1500</td>
</tr>
<tr>
<td></td>
<td>Obtaining a Job with a Graduate Degree</td>
</tr>
<tr>
<td>4:30pm - 5:00pm</td>
<td>Awards Presentation and Closing Remarks</td>
</tr>
<tr>
<td></td>
<td>– EECS 1500</td>
</tr>
</tbody>
</table>
Presentations

Bio-Engineering
Chair: Nikhil Mudaliar

Session I - EECS 1005

Alaa A. Ahmed 9:30 am
Defining Loss of Balance using Adaptive Failure Detection

Niranjan Deo 9:50 am
3-D FEM Modeling for Global Cochlear Dynamics

Bing-Shiang Yang 10:10 am
On Not Tipping a Stepladder

Jaebum Son 10:30 am
How Human Can Stand on One-Leg

Session II - EECS 1005

Jia-Hsuan Lo 1:40 pm
Hand Impact Force Reduction in Forward Falls: A Prospective, Controlled, 3-Month Intervention Trial in Young Males

Kathleen DeSantis Klinich 2:00 pm
Estimating Infant Head Injury Criteria and Impact Response using Finite Element Modeling and Crash Reconstruction

Peggy Meinhart 2:20 pm
Why are the Elderly at Increased Risk for Falling While Turning?

Sarah Calve 2:40 pm
Influence of Mechanics on Muscle and Tendon Development

B. E. Layton 3:00 pm
Experiments on Diabetic Sprague-Dawley Rat Nerve and Nerve Collagens

Design and Manufacturing
Chair: Harsha Badarinarayan

Session I - EECS 1200

Charles Kim 9:30 am
Design of a Novel Compliant Transmission for Secondary Microactuators in Disk Drives

Byungwoo Lee 9:50 am
Decomposition-based Assembly Synthesis for In-Process Dimensional Adjustability

Qiang Huang 10:10 am
Simultaneous Tolerance Synthesis through Process Modeling

Brian Patrick Trease 10:30 am
Design of Large-Displacement Compliant Joints

Guo Xu 10:50 am
Simulation of Gas Metal Arc Welding Short Circuiting Transfer using a Front Tracking Method

Session II - EECS 1200

Harsha Badarinarayan 1:40 pm
Dynamic Air Brake System Modeling for Medium Size Trucks

Theodor Freiheit 2:00 pm
Productivity of Serial Transfer Lines with Reserve Capacity and Buffers

Karim Hamza 2:20 pm
Design Optimization for Crashworthiness of Vehicles using Equivalent Mechanism Approximations

Kerr-Jia Lu 2:40 pm
Compliant Mechanism Synthesis for Shape Change Applications

Valerie Maier-Speredelozzi 3:00 pm
Manufacturing System Convertibility Analysis
Dynamics, Systems and Controls  
Chair: Haitham Mahmoud

Session I - EECS 1301

Mahmoud I. Hussein 9:30 am  
Design of Periodic Structures for Desired Dispersive Behavior

S. L. Pollice 9:50 am  
A Methodology for Generating the Part Handling Logic Control of a Flexible Manufacturing System

Ashish Deshpande 10:10 am  
Enhanced Mobility via Cooperation

Don Lochner 10:30 am  
Modeling, Identification and Air Flow Control of a Low Pressure Fuel Cell Stack with a DC Blower

Farshid Maghami Asl 10:50 am  
Optimal Capacity Management in Stochastic Market Demands

Jinzong Wang 11:10 am  
Development of Advanced Methodologies for Internet-Distributed Simulation

Paul G. Otanez 11:30 am  
Ethernet as a Control Network: Guidelines and Implications

Session II - EECS 1301

Haitham A. Mahmoud 1:00 pm  
Target Reduction and Balancing using System Norms

Ali Yigit Ungoren 1:20 pm  
A Flexible Lateral Preview/Predictive Human Driver Model

Girish Mudgal 1:40 pm  
Terrain Characterization for Durability Predictions

Hosam K. Fathy 2:00 pm  
Nested Plant/Controller Optimization with Application to Combined Passive/Active Automotive Suspensions

Ardalan Vahidi 2:20 pm  
System Identification Techniques for Longitudinal Control of Heavy-Duty Vehicles

Szabolcs Sovenyi 2:40 pm  
Analysis and Cancellation of Vibration Feedthrough in Joystick Controlled Vehicles

Olivier Poudou 3:00 pm  
Modeling of Bladed Disks Assemblies in Presence of Periodic Frictional Contact

Fluid Mechanics, Heat Transfer and Combustion  
Chair: Ramanan Sankaran

Session I - EECS 1001

Ramanan Sankaran 9:30 am  
A Computational Study of the effects of EGR on the HCCI Engine Performance

Xin He 9:50 am  
The Study of Ignition Delay Times in HCCI Combustion Systems

Christos Chryssakis 10:10 am  
An Enhanced Liquid Sheet DISI Spray Model Accounting for Swirl Effects

Charles Funk 10:30 am  
Turbulence Properties of High and Low Swirl In-Cylinder Flows

Aristotelis Babajimopoulos 10:50 am  
Modeling the Effects of Gas Exchange Processes on HCCI Combustion

Tershia Pinder 11:10 am  
Experimental and Computational Investigation of Dynamic Control Strategies for an Ethylene Diffusion Flame

Luciana W. da Silva 11:30 am  
Micro Thermoelectric Cooler

Session II - EECS 1001

J. J. Kirchner 1:20 pm  
Dispersion of Solute in Spatially-Periodic Chromatography Media

Guo Xu 1:40 pm  
One Dimensional Analysis of Gas Metal Arc Welding (GMAW) Metal Transfer

Rui Zhang 2:00 pm  
Laser-Induced Fluorescence (LIF) Tracers and their Characterization

Alan McGaughey 2:20 pm  
Distinct Components of Lattice Thermal Conductivity

Mong-Tung Lin 2:40 pm  
Mixture Evaporative Characteristics Prediction using PSRK Equation of State for a LIF Liquid Fuel Film Measurement

Melissa Chernovsky 3:00 pm  
Unsteady Spherical Diffusion Flames in Microgravity
Solid Mechanics and Materials
Chair: Matt Cavalli

Session I - EECS 1003

Hashem Mourad 9:30 am
Modeling of Void Formation in Polycrystalline Solids

Dung-An Wang 9:50 am
Modified Anisotropic Gurson Yield Criterion for Porous Ductile Sheet Materials with Planar Anisotropy

Sung-Tae Hong 10:10 am
Macroscopic Crush Behavior of Honeycomb Materials: Static Test

Matthew Cavalli 10:30 am
Modeling the Deformation and Fracture of Weldbonded Joints

Kyoo-Sil Choi 10:50 am
Fatigue Life Prediction of Fillet Rolling Tool of Crankshaft

Session II - EECS 1003

Shawn Lin 1:40 pm
Fatigue Life Predictions for Spot Welds in Various Specimens

Parag Dixit 2:00 pm
Variational Multiscale Methods to Embed Macromechanical Formulations with Fine Scale Polymers

Steven L. Creighton 2:20 pm
Coupling a Fine-Scale Constitutive Equation into the Macroscale Equation of Motion via Variational Multiscale Techniques

Essam Al-Bahkali 2:40 pm
A Steady State Solution of Thermoelastic Sliding Contact Bodies using Finite Element Method

Mahmoud I. Hussein 3:00 pm
Frequency Domain Dispersive Modeling of Infinite Periodic Structures

Posters

Bio-Engineering

Alaa A. Ahmed B-1
Defining Loss of Balance using Adaptive Failure Detection

J. H. Blumenfeld B-2
Phenotyping a New Transgenic Mouse Model for Schmid Metaphyseal Condrodysplasia

Bing-Shiang Yang B-3
On Not Tipping a Stepladder

Solid Mechanics and Materials

Essam Al-Bahkali S-1
A Steady State Solution of Thermoelastic Sliding Contact Bodies using Finite Element Method
Design and Manufacturing

**Harsha Badarinarayan**  M-1  
Dynamic Air Brake System Modeling for Medium Size Trucks

**Nathan Bair**  M-2  
Design of a Reconfigurable Assembly System for Manufacturing Heat Exchangers

**Haseung Chung**  M-3  
Numerical Modeling of One-Dimensional Laser-Induced Melting and Solidification in Metals Subjected to Time-Dependent Heat Input

**Adam Cooper**  M-4  
Enterprise Driven Analytical Target Setting

**Karim Hamza**  M-5  
Design Optimization for Crashworthiness of Vehicles using Equivalent Mechanism Approximations

**Dejun Jing**  M-6  
Numerical and Experimental Study on the Flow of Fine Powders from Small-Scale Hoppers

**Chang-Ju Kim**  M-7  
Chip Formation and Cutting Forces in Micro-Milling

**Jeonghan Ko**  M-8  
The Impact of Product Architecture on the Reusability of Manufacturing Systems and the Environment

Dynamics, Systems and Controls

**Ashish Deshpande**  D-1  
Enhanced Mobility via Cooperation

**Jae Hong Lee**  D-2  
Real-time Simulation of Tracked Vehicles

**Don Lochner**  D-3  
Modeling, Identification and Air Flow Control of a Low Pressure Fuel Cell Stack with a DC Blower

**Haitham Mahmoud**  D-4  
Target Reduction and Balancing using System Norms

**Hyungpil Moon**  D-5  
Computing Equilibria on Superpositions of Logarithmic-Radial Potential Fields

**Szabolcs Sovenyi**  D-6  
Analysis and Cancellation of Vibration Feedthrough in Joystick Controlled Vehicles

**Jinzhong Wang**  D-7  
Development of Advanced Methodologies for Internet-Distributed Simulation
Fluid Mechanics, Heat Transfer and Combustion

Aristotelis Babajimopoulos F-1
Modeling the Effects of Gas Exchange Processes on HCCI Combustion

Christos Chryssakis F-2
Cavitation and Internal Flow Calculation inside a Diesel Injector VCO Nozzle

Udo Fissenewert F-3
Laser Spectroscopic Investigations of NOx Formation in a Direct Injection Spark Ignited Engine Featuring Optical Access

Charles Funk F-4
Turbulence Properties of High and Low Swirl In-Cylinder Flows

Mong-Tung Lin F-5
Mixture Evaporative Characteristics Prediction using PSRK Equation of State for a LIF Liquid Fuel Film Measurement

Sneha Madhayan-Reese F-6
Novel Microfluidic Devices using Mobile Polymer Monoliths

Alan McGaughey F-7
Distinct Components of Lattice Thermal Conductivity

Tiffany Miller F-8
A Computational Study of Silane Combustion

Jin Hyun Nam F-9
Effective Diffusivities of Fibrous Gas-Diffusion-Layer