ARC Collaborative Research Seminar Series
Fall 2004

September 16th, Thursday (1:30-3:00pm)
University of Michigan, Lurie Engineering Center, Level 3, Johnson B & C Rooms

Presented by Thrust Area 4:

Introduction and Overview of Projects at Wayne State University
Prof. Naeim A. Henein, Wayne State U.

Evaluation of the Low-Temperature Diesel Combustion Concepts and Proposed New Strategy
Prof. Naeim A. Henein, Wayne State U.

Introduction and Overview of Projects at The University of Michigan
Prof. Dennis N. Assanis, U. of Michigan

Dual Use Multiple Injection Strategies for Improved Performance/Emissions Tradeoff
Jonathan Hagena, Alexander Knafl, Christos Chryssakis, Zoran Filipi, Dennis N. Assanis, U. of Michigan

Thermal Modeling of Proton Exchange Membrane Fuel Cell
Sangseok Yu, Dohoy Jung, and Dennis N. Assanis, U.of Michigan

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October 7th, Thursday (1:30-3:00pm)
University of Michigan, Lurie Engineering Center, Level 3, Johnson B & C Rooms

Thrust Area 3 – New Research Initiatives for ARC III

Topology Optimization for Innovative Structures and Materials
Zheng-Dong Ma and Noboru Kikuchi
Department of Mechanical Engineering, University of Michigan

(click here for abstract)

October 21st, Thursday (2:15-4:00pm)
University of Michigan, Lurie Engineering Center, Level 3, Johnson B & C Rooms

Presented by Thrust Area 1:

Control Critical Alternative Energy/Power Systems
Anna Stefanopoulou and Jeff Stein, University of Michigan

(click here for abstract)

November 10th, Wednesday (9:00-10:30am)
University of Michigan, Lurie Engineering Center, Level 4, GM Room

Presented by Thrust Area 2:
Modeling Vehicle Ride Motion Affects on Human Operators

Introduction & Moderator
Don B.Chaffin, Distinguished Univ.Professor, U. of Michigan

Overview of Bio-dynamic Modeling of Vehicle-Operator Systems
Wade Allen, Technical Director, Systems Technology Inc.

Vibration Affects on Neural-motor Control
Bernard Martin, Associate Prof., IOE, U. of Michigan

Vehicle Motion Affects on Operator Pointing Tasks
Kevin Rider, PhD Candidate, IOE, U. of Michigan

Vehicle Control and Haptics Modeling
Brent Gillespie, Assist.Prof., ME, U. of Michigan

Vehicle Motion Feed-through Cancellation Modeling
Szabolcs Sovenyi, PhD Candidate, ME, U. of Michigan

December 8th, Wednesday (9:00-10:30am)
University of Michigan, Lurie Engineering Center, Level 4, GM Room

Presented by Thrust Area 5 on
Vehicle System Integration, Optimization and Robustness:
Progress and Vision

Collaborative, Distributed Mobility and Simulation Systems
Gregory Hulbert (U. of Michigan)

Tradeoff-based Decision Support for Multi-Criteria Vehicle Design
Margaret M. Wiecek, Vincent Y. Blouin, Georges M. Fadel (Clemson U.)

Uncertainty Quantification Approaches in Optimal Design and Robustness Formulations
Jinhong Liang and Zissimos Mourelatos (Oakland U.) Miles Chan, Subroto Gunawan, Michael Kokkolaras, and Panos Papalambros (U. of Michigan)

Robust Design of Products for People
Matthew Parkinson and Matthew Reed (U. of Michgian)

(click here for abstract)

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ARC Collaborative Research Seminar Series
Abstracts for Fall '04

September 16th

Presented by Thrust Area 4.
No abstracts available.

October 7th

Thrust Area 3 – New Research Initiatives for ARC III
Topology Optimization for Innovative Structures and Materials
Zheng-Dong Ma and Noboru Kikuchi
Department of Mechanical Engineering, University of Michigan

Topology optimization has received extensive attention in recent years. Significant progress has been made with a variety of different approaches, which has led to the development of commercial codes. Recent research conducted at The University of Michigan has focused on bringing the topology optimization technique to the next major level, such that it can be used to design truly practical (that is, manufacturable) structures and materials. This includes the development of a function-oriented material design method and an advanced multi-domain/multi-level/multi-step topology optimization process. Such a process can be used to design complex engineering structures for next-generation ground vehicles and aircraft, and it can significantly enhance manufacturability of the designs resulting from the topology optimization. In this seminar, both structural design aspects (Zheng-Dong Ma) and material design aspects (Noboru Kikuchi) of topology optimization will be presented. New research initiatives for ARC III will be discussed, with a focus on safety design for protecting our soldiers and civilians. A number of example applications will also be presented to illustrate how the new techniques can be used for producing innovative structures and materials.

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October 21st

Thrust Area 1 – Control Critical Alternative Energy/Power Systems
Anna Stefanopoulou and Jeff Stein, University of Michigan

Alternative power systems, as with conventional power system, are subject to a wide of loads. This requires control of the series of actuators such as reactors, valves, pumps, compressor motors, expander vanes, heat exchangers, humidifiers, and condensers that make up these systems. Intelligent and model-based control is needed to automatically make fine and fast adjustments to satisfy performance and reliability standards that are independent of age and operating conditions.

To this end, the combined efforts of present Thrust Area #1 researchers and their colleagues on industrial and military vehicle alternative power systems will be presented. The talk will be divided into two parts:

A - Summary of results from two ARC funded project on fuel cell hybridization (Huei Peng) and oxygen starvation (Anna Stefanopoulou)

B - Models and control issues from ARC related projects on fuel cell cooling (John Wagner) and

combined heat power (CHP) cycles that enable fuel processing (Jing Sun).

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November 10th

Presented by Thrust Area 2.
No abstracts available.

December 8th

Presented by Thrust Area 5 on
Vehicle System Integration, Optimization and Robustness:
Progress and Vision

Collaborative, Distributed Mobility and Simulation Systems
Gregory Hulbert (U. of Michigan)
In this part of the presentation, we will highlight the progress made towards building a toolkit for integrating different thrust area simulation platforms with an aim towards including terrain deformation and vehicle compliance into existing and future ground vehicle platforms. We will also outline the proposed effort towards establishing a HMMWV toolkit that can be used for proposed ARC 2005 research.

Tradeoff-based Decision Support for Multi-Criteria Vehicle Design
Margaret M. Wiecek, Vincent Y. Blouin, Georges M. Fadel (Clemson U.)
The vehicle design problem is a complex decision problem with many conflicting criteria. Due to high dimensionality, the problem may be numerically intractable and, due to incompatibility between the criteria, the designer may not be able to evaluate tradeoffs and make a comprehensive decision leading to a final design. The objective of this research is to decompose the overall problem by considering pairs of criteria at a time in a way that allows the designer to perform meaningful tradeoff analyses, and to develop a subsequent integration approach. The integration should guarantee that solving the overall problem becomes equivalent to individually solving a family of bi-criteria problems. This equivalence is a novel and highly desirable but not yet discovered feature of multi-criteria optimization and would allow designers to use optimization as a tool to facilitate decision-making.

Uncertainty Quantification Approaches in Optimal Design and Robustness Formulations
Jinhong Liang and Zissimos Mourelatos (Oakland U.) Miles Chan, Subroto Gunawan, Michael Kokkolaras, and Panos Papalambros (U. of Michigan)
In this talk we revisit the uncertainty quantification problem and compare an alternative optimal design approach with a previously presented probabilistic one. The motivation is that sufficient data is not available in the early design process, for advanced technologies, or operating conditions of the vehicles to be designed. Therefore, probability distributions for uncertainties are not generally and readily available to employ probabilistic design approaches. We use interval analysis for quantification of impact of uncertainties and implement a possibilistic design approach for a vehicle design problem and compare the results. We also present formulations for combined reliability and robustness design that have been developed and will be tested with respect to their suitability for multilevel design optimization with applications in vehicle design.

Robust Design of Products for People
Matthew Parkinson and Matthew Reed (U. of Michgian)
No abstracts available.

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