RAS Home

ICRA 2000 Home

**MONDAY 24 APRIL, 2000 (Half-Day Tutorials)**

**Morning Tutorials: 8:00 a.m.-12:00 Noon. Coffee break 10:00-10:15am. Locations: Hilton Hotel: 2nd floor, Continental Ballrooms (CB) 1,2,3,7**

T1 Vision for Mobile Autonomous Robots: Navigation, Dynamics and Control
*Organizers:* Robert Mahony and Tarek Hamel

T2 Multi-Agent View of Coordinating Multiple Robot Systems
*Organizers:* Yves Demazeau and Humbert Fiorino

T3 Behavior-Based Robotics
*Organizers:* Maja J. Mataric' and Ronald C. Arkin

T4 Cleaning and Housekeeping Robots
*Organizers:* Paolo Fiorini and Erwin Prassler

**FRIDAY 28 APRIL, 2000 (Full-Day Workshops and One Tutorial)**

**SCHEDULE**
**8:00-10:00 a.m.**
**BREAK: 10:00-10:15**
**10:15-12 Noon**
**LUNCH: Noon-1:00 p.m.**
**1:00-3:00 p.m.**
**BREAK: 3:00-3:15 p.m.**
**3:15-5:00 p.m.**

**Locations: Hilton Hotel, 4th floor, Union Square rooms. Room Assignments will be posted by Registration Desk during the conference and nearby that day.**

W1 Reality-based Modeling and Applications in Reverse Engineering, Computer Graphics, and VR
*Organizer:* Dinesh K. Pai

W2 Mobile Micro-Robots *Organizers:*

# ICRA2000

# IEEE International Conference on Robotics and Automation

## San Francisco, April 24-28, 2000

## Workshops and Tutorials

### Monday, 24 April 2000
### Friday, 28 April 2000

ICRA is well known for the quality of the workshops and tutorials associated with the conference. This year we plan to offer four half-day tutorials on the Monday preceding the conference and nine full day workshops and one full day tutorial on the Friday following the conference. You've got a great excuse for a weekend in San Francisco and save on plane fare! Click on the Workshop (W-) or Tutorial (T-) title to go to the description. Registration information is available at the ICRA2000 homepage http://robotics.stanford.edu/ICRA2000.

Register early to make sure the workshop/tutorials you are interested in "make", that sufficent materials will be available, and we can have rooms of the appropriate size.

### MONDAY 24 APRIL 2000
### HALF-DAY TUTORIALS

**T1 Monday April 24**
**Vision for Mobile Autonomous Robots: Navigation, Dynamics and Control.** *Organizers*
**Robert Mahony** *Department of Electrical and Computer Systems/ Engineering/ Monash University, Clayton, Victoria, 3168, Australia. email:* mahony@ieee.org
**Tarek Hamel** *CEMIF, Universite d'Evry, 40 rue du Pelvoux, CE 1455 Courcouronnes, 91025 France. email:* thamel@iup.univ-evry.fr

As more and more robotic applications emerge in unstructured and partially unknown outdoor environments there is a strong need for the continuing development of accurate, effective navigation techniques, and especially for reliable vision based systems. This tutorial aims to provide a balanced perspective on emerging technologies for computer vision in mobile robotics. The topics covered include; sensing

Roland Siegwart

W3 Personal Robotics for Education
*Organizer:* John Canny

W4 Mobile Robot Navigation and Mapping
*Organizers:* John J. Leonard and Juan Domingo Tardos

T5 Structure from Motion in Computer Vision: A Geometric Viewpoint (Full Day Tutorial)
*Organizers:* Jana Kosecka and Shankar Sastry

W5 Flexible Parts Feeding and Fixturing: From Research to the Factory Floor
*Organizers:* Greg Causey and Albert Pedrazza

W6 Smart Mechanisms
*Organizers:* Tatsuo Arai, Tamio Arai and Koichi Sugimoto

W7 Vehicle Teleoperation Interfaces
*Organizer:* Terry Fong

W8 Integrating Sensors with Mobility and Manipulation
*Organizers:* Kamal K. Gupta, Angel del Pobil and Howie Choset

W9 Self-Organization in Robotics and Flexible Manufacturing
*Organizer:* Jens Starke

**ICRA 2000 April 24-27.**
**San Francisco, California, USA.**

systems and navigation algorithms for autonomous machines in field robotics, recent developments of vision based methods in mobile robot navigation, and insights for autonmous navigation obtained from studying biological vision systems. The tutorial concludes with some recent work on integrating modern non-linear control techniques with vision measurements.

*Speakers*
Eduardo Nebot *Department of Mechanical and Mechatronic Engineering University of Sydney, Australia*
J. Ostrowski *Department of Mechanical Engineering and Applied Mechanics, University of Pennsylvania, USA)*
.Alex Zelinsky *Research School of Information and Engineering Sciences, Institute of Advanced Studies, Australian National University, Canberra*
T. Hamel *CEMIF, Universite d'Evry, France*
Madyam Srinivasan *Research School of Biological Sciences, Institute of Advanced Studies, Australian National University, Canberra*
R. Mahony *Department of Electrical and Computer Systems Engineering Monash University, Clayton, Australia*

**T2 Monday April 24**
**A Multi-Agent View of Coordinating Multiple Robot Systems**
*Organizers*
**Yves Demazeau** *CNRS Grenoble, LEIBNIZ Laboratory*
demazeau@capella.imag.fr
**Humbert Fiorino** *Grenoble University, LEIBNIZ Laboratory*
Humbert.Fiorino@imag.fr

Laboratory Multi-Agent Systems (MAS) are increasingly interesting technologies for coordinating and controlling multiple robot systems which have to share environments while cooperating and avoiding conflicts. Decomposing missions into elementary tasks and allocating these to agents with specific capabilities, while coordinating them in real-time are interdependent problems which entail complex dynamics and feedback. In this tutorial, we first explore traditional approaches in the light of MAS methodology. We then discuss reactive approaches and how they fit into the agent and multi-agent environment paradigm. Finally, we discuss more complex approaches where the inputs are the interactions and organization of the multiple agents. The tutorial will be illustrated with a number of applications from the fields of robotics, intelligent manufacturing systems and distributed traffic control.

*Speakers*
Yves Demazeau *CNRS Grenoble, France LEIBNIZ Laboratory*
Humbert Fiorino *University of Grenoble, France / LEIBNIZ Laboratory*
John Perram *University of Southern Denmark, Odense / MIP Institute*

**T3 Monday April 24**
**Behavior-Based Robotics**
*Organizers and Presenters:*

**Maja Mataric** *University of Southern California,*
mataric@pollux.usc.edu
**Ronald Arkin** *Georgia Institute of Technology,*
arkin@cc.gatech.edu

Behavior-based robotics has emerged as one of the leading approaches to mobile robot control. It has been effectively applied to modeling biological systems, studying difficult robotics problems (e.g., multi-robot control, learning), and to real-world applications (e.g., Mars Pathfinder, vacuum cleaners, lawn mowers, battlefield robotics). This tutorial will survey the history, current state-of-the-art, and the research directions of behavior-based robotics. We will describe its interdisciplinary origins, and relations to classical deliberative, reactive, and hybrid control. Methods for system synthesis and analysis will be covered, as well as examples of various real-world applications. Video illustrations will be provided.

**T4 MONDAY 24 APRIL, 2000**
**Cleaning and Housekeeping Robots**
*Organizers*
**Erwin Prassler***Research Institute for Applied Knowledge Processing (FAW)*,prassler@faw.uni-ulm.de
**Paolo Fiorini***Jet Propulsion Laboratory (JPL)*
fiorini@jpl.nasa.gov

While the design of a versatile personal robot is debated in Academia and Industry, its precursors are becoming commercial products. Cleaning robots for private households as well as public environments seem to be solving some of the long-standing problems of non-industrial robots: they offer a useful service, have moderate costs, and do not eliminate any jobs. Furthermore, as they operate in natural everyday environments, their development and operation will provide an invaluable experience for the design of personal robots. This tutorial addresses the key research and development aspects of cleaning and housekeeping robots. In the first section we give a comprehensive overview of existing cleaning robots. This overview comprises house vacuum cleaners, pool cleaners, industrial floor scrubbers, and duct cleaning robots. In the second part we discuss specific aspects of system and algorithm design related to cleaning robots, including sensing, positioning, motion planning, and task planning.

*Speakers*
Erwin Prassler *Research Institute for Applied Knowledge Processing (FAW)* Paolo Fiorini *Jet Propulsion Laboratory (JPL)*

## FRIDAY 28 APRIL, 2000
## FULL DAY WORKSHOPS AND TUTORIAL

**T5 Friday 28 April, 2000**
**Structure from Motion in Computer Vision: A Geometric Viewpoint**.
*Organizers*
**Jana Kosecka** *George Mason University*
kosecka@cs.gmu.edu
**Shankar Sastry** *University of California-Berkeley*

sastry@eecs.berkeley.edu

The problem of estimating 3-D structure, motion and camera calibration - a classical problem in Computer Vision, will be presented within a framework accessible to the robotics community. We will use notation and tools from kinematics and modern geometry and demonstrate that the natural formulation of these problems in a differential geometric setting in leads to a unified treatment of both the discrete and continuous case as well as the calibrated and uncalibrated case. We will review recent novel theoretical results, the conditioning of the problem solutions in the presence of measurement noise as well as the criticality and robustness of certain classes of camera motions. The practical impact of the proper theoretical treatment, for both the estimation problems and the subsequent control synthesis, will be immediately apparent and demonstrated on the applications to robotic control of unmanned aerial and ground vehicles and augumeted reality. The tutorial will offer a unified presentation of fundamental problems in this area.

*Speakers*
Yi Ma *University of California Berkeley*
Jana Kosecka *George Mason University, Fairfax*
Stefano Soatto *Washinton University, St. Louis*
Shankar Sastry *University of California, Berkeley*
Carlo Tomasi *Stanford University*
Kostas Daniilidis *University of Pennsylvania, Philadelphia*

**W1 Friday April 28, 2000 Reality-based Modeling and Applications in Reverse Engineering, Computer Graphics, and VR**
*Organizer*
**Dinesh K. Pai** *Department of Computer Science, University of British Columbia, Vancouver, CANADA*

Building realistic models of existing objects presents both a novel challenge for robotics and an important area of applications. Shape acquisition is already an essential part of applications such as reverse engineering and computer graphics. New technologies for rapid acquisition of physical properties such as reflectance, surface friction and roughness, and contact sounds are emerging, with the potential to acquire rich, multi-modal models. This workshop will bring together researchers from academia and industry to present strategies for reality-based modeling and for the use of robotic measurement facilities to automatically acquire comprehensive models. See http://www.cs.ubc.ca/~pai/RealityWorkshop.html for more information.

*Speakers*
Peter Allen (Columbia)
Pierre Boulanger (NRC, Ottawa)
Ruzena Bajcsy (Penn and NSF)
John Canny (Berkeley)
Brian Curless (U. Washington)
Vincent Hayward (McGill)
Rob Howe (Harvard)
Pierre Dupont (BU)

Katsushi Ikeuchi (U. Tokyo)
Takeo Kanade (CMU)
Christian Laugier (INRIA)
Karon MacLean (Interval)
Allison Okamura (Stanford)
Dinesh Pai (UBC)
Holly Rushmeier (IBM)
Ken Salisbury (Stanford/Intuitive Surgical)

**W2 Friday April 28, 2000**
**Mobile Micro-Robots**
*Organizer*
**Roland Siegwart** *EPFL, Swiss Federal Institute of Technology*

Recent advances in micro-technology and bio-inspired robotics triggered various research initiatives in the field of mobile micro robots. Such very small mobile robots with a weight of only a couple grams are getting high attraction fare beyond the research community. First prototypes of wheeled, walking or even flying micro-robots are appearing from this fast growing research field. Nevertheless, this exciting field is still in its very beginning, searching for new technology and real applications. The goal of this workshop at ICRA'2000 is to establish the state of art in the field of mobile micro-robots, to discuss current and future trends, to identify the required technology and to argue potential applications. It will assemble researchers of various fields with a common dream and initiate collaboration between researchers in robotics, MEMS, artificial intelligence and much more.

*Speakers*
Roland Siegwart *EPFL, Swiss Federal Institute of Technology*
Gilles Caprari *ISR, Swiss Federal Institute of Technology*
Kristofer Pister *University of California, Berkeley*
Ronald Fearing *UC Berkeley*
Matthew Mason *Carnegie Mellon University*
Isao Shimoyama *University of Tokyo*
Michael Goldfarb *Vanderbilt University*
Toshio Fukuda *Nagoya University*
Brian Wilcox *Jet Propulsion Laboratory*
Ray Byrne *Sandia National Laboratories, USA*
Steven Eskridge *Sandia National Laboratories, USA*
John Harrington *Sandia National Laboratories, USA*
Johnny Hurtado *Sandia National Laboratories, USA*
Jean-Daniel Nicoud *LAMI, Swiss Federal Institute of Technology, Lausanne (EPFL)*
Roman Schmied *LAMI, Swiss Federal Institute of Technology, Lausanne (EPFL)*
Jong-Hwan Kim *KAIST, Korea*
Giovanni Muscato *University of Catania*
Kazuhiro Tsuruta *Denso Research Laboratories, JP*
Takanari Sasaya *Denso Research Laboratories, JP*
Nobuaki Kawahara *Denso Research Laboratories, JP*
Kevin Bailey *Diversified Enterprises, USA*

**W3 Friday April 28, 2000**
**Personal Robotics**
*Organizers*:
**John Canny** *University of California- Berkeley,Computer*

*Science Division,387 Soda Hall, CA 94720 (USA)*
jfc@cs.berkeley.edu
**Howie Choset** *Carnegie-Mellon University,Scaife Hall Pittsburgh , PA 15213* choset@cs.cmu.edu 4.

This workshop is about the exciting area of personal robotics. Following on from the very successful PR workshop at ICRA99, we will cover the application of robotics to novel and "human-centered" contexts. Personal robots interact with their environments like service robots, with the qualification that the most important part of the environment is the people in it. So personal robotics emphasizes human-machine co-existence and communication. Personal robotics spans the spectrum from small and simple internet appliances with movement and sensing capabilities, up to complex robots with anthropomorphic function or form. This workshop has a particular emphasis on robots for education. There are several ways to apply robotics to education: (i) Robots are challenging artifacts that can be built by children to teach engineering, programming and physics concepts; (ii) Robots can be used as "mentors" or learning partners; (iii) Telepresence and sensor-enabled robots can allow children to explore new domains that are normally inaccessible to them because of remoteness, safety, or scale.

*Speakers*
John Canny *University of California- Berkeley*
Howie Choset *Carnegie-Mellon University*
Allison Druin *Universtiy of Maryland*
Ron Arkin *Georgia Institute of Technology*
lla Nourbakhsh (*Carnegie-Mellon University*
Blake Hannaford *University of Washington*
Kazuo Tanie *Tsukuba University*

**W4 Day: FRIDAY 28 APRIL, 2000**
**Mobile Robot Navigation and Mapping**
*Organizers*
**John J. Leonard** *Massachusetts Institute of Technology, Dept. of Ocean Engineering, Room 5-422, 77 Mass ave. Cambridge, MA 02139-4307 USA 253-8125*
jleonard@mit.edu http://oe.mit.edu/~jleonard
**Juan Domingo Tardos** *Dep. de Informatica e Ingenieria de Sistemas Centro Politecnico Superior, Universidad de Zaragoza Maria de Luna, 3 - 50015 Zaragoza, Spain*
tardos@posta.unizar.es http://www.cps.unizar.es/~jdtardos/

The motivation for the workshop is to bring together researchers who have made recent progress on the problem of mobile robot mapping and navigation so that different approaches can be compared and the current state-of-the-art can be assessed. The workshop will focus in particular on the problem of concurrent mapping and localization. The goal is to enable a mobile robot to build a map of an unknown environment while simultaneously using that map for navigation. Concurrent mapping and localization presents a variety of theoretical challenges and is vitally important for many envisioned applications of mobile robots.

*Speakers*
Raja Chatila, *LAAS, Toulouse, France*

Sebastian Thrun *Carnegie Mellon University*
Martial Hebert *Carnegie Mellon University*
Hugh Durrant-Whyte *University of Sydney, Australia*
Gamini Dissanayake *University of Sydney, Australia*
Jose Castellanos *University of Zaragoza, Spain*
Jose Neira *University of Zaragoza, Spain*
John Leonard *Massachusetts Institute of Technology*
Uwe Hanebeck *Technical University of Munich*
Shinichi Yuta *University of Tsukuba, Japan*
Kurt Konolige *Stanford Research Institute, USA*

**W5 Friday, April 28 2000**
**Flexible Parts Feeding and Fixturing: From Research to the Factory Floor** *Organizers*
**Greg Causey** *Case Western Reserve University, Cleveland Ohio, 44106-7222* gcc@pris.eeap.cwru.edu
http://dora.eeap.cwru.edu/gcc
**Albert Pedrazza** *Adept Technology, Inc.*

Flexible feeders allow a wide variety of components to be fed with little change in hardware. Flexible fixturing allows fixtures to be systematically (and automatically) designed from reusable components. While these technologies would be useful to automation, their acceptance is slow in coming. Is this lack of implementation due to industry not knowing the current state of research or is it due to researchers not pursuing the types of problems industry is facing? A dialogue must be established. The purpose of the workshop is to help establish this dialogue by: 1) Examine the current state of research/ development in flexible feeding/fixturing and state of use in industry. 2) Open a discussion between industry and researchers so these efforts might be better aligned.

*Speakers*
Srinivas Akella *University of Illinois at Urbana-Champaign*
Greg Causey *Case Western Reserve University*
William Murray *California Polytechnic State University*
Albert Pedrazza, *Adept Technology, Inc.*
Aaron Wallack *Cognex Corporation*
Michael Wang *University of Maryland (Currently Visiting Chinese University of Hong Kong)*
Greg Causey *Case Western Reserve University*
Leonhard Mugratsch, *Valeo Electronics*
Victor Trotter, *Spectra Technologies*

**W6 Friday, April 28, 2000**
**Smart Mechanisms**
*Organizers*
Tatsuo Arai *Osaka University* arai@sys.es.osaka-u.ac.jp
Tamio Arai *University of Tokyo*
Koichi Sugimoto *Kagawa University*

The crucial issue in robotics is how robots achieve their smartness; flexibility, adaptability, autonomy and intelligence. The full day workshop offers occasions to discuss answers to this question in the aspect of robotic mechanisms. The sound advancement of robotics requires good mechanism design as well as brain development based on the information

technology. There are several aspects for the discussion; mechanism design and motion control algorithm to achieve smartness, modeling animals and the human form, modeling human functions with or without tools, mechanisms capable of higher performance than human beings, micro and huge robots, etc.

*Speakers*
Tamio Arai *University of Tokyo*
Tatsuo Arai *Osaka University*
Karsten Berns *FZI*
Pierre Douchez *LIRMM, University of Montpellier*
Toshio Fukuda *Nagoya University*
Aarne Halme *Helsinki University of Technology*
Shigeo Hirose *Tokyo Institute of Technology*
Takeo Ohmichi *Mitsubishi Heavy Industry*
Francois Pierrot *LIRMM, University of Montpellier*
Isao Shimoyama *University of Tokyo*
Koichi Sugimoto *Kagawa University*
Atsuo Takanishi *Waseda University*

**W7 Friday 28 April 2000**
**Vehicle Teleoperation Interfaces**
*Organizers*
**Terry Fong** *Carnegie Mellon University & Swiss Federal Institute of Technology* terry@cs.cmu.edu
**Chuck Thorpe** *Carnegie Mellon University* cet@cs.cmu.edu

Sophisticated interfaces for teleoperation have become increasingly important. In many applications, human-robot interaction is the fundamental factor governing performance. Thus, it is critical that we learn how to design efficient interfaces and to build truly integrated systems. In this workshop, we will discuss the state-of-the-art in vehicle teleoperation, from direct control to supervised autonomy. We will cover the design, implementation and use of interfaces for a broad range of applications (ground, underwater, air, space). Leading researchers will present experiences and lessons learned from real-world systems. The workshop will culminate with a panel to identify key challenges and future applications.

For more information about the workshop, see http://imtsg7.epfl.ch/projects/ati/icra2000.shtml.

*Speakers*
Wendy Amai *Sandia National Laboratory*
Phil Ballou *Deep Ocean Engineering, Inc.*
Terry Boult *Lehigh University*
Donny Ciccimar *Space and Naval Warfare Systems Center*
Brian Cooper *NASA Jet Propulsion Laboratory*
Mark Draper *Wright-Patterson Air Force Base*
Terry Fong *Carnegie Mellon University*
David Hainsworth *CSIRO Exploration and Mining, Queensland, Australia*
Aarne Halme *Helsinki University of Technology*
Laurent Nguyen *NASA Ames Research Center*
Eric Paulos *University of California Berkeley*

**W8 Friday, April 28, 2000**

**Integrating Sensors with Mobility and Manipulation**

*Organizers*
**Kamal K. Gupta** *Simon Fraser University, BC, Canada* kamal@cs.sfu.ca
**Angel del Pobil** *University Jaume I, Spain* pobil@inf.uji.es
**Howie Choset** *Carnegie Mellon University*, USA choset@cs.cmu.edu

The workshop presents the state of the art and a broad and comprehensive overview of integrating sensors into mobility and manipulation, the two pillars of autonomous robots. A wonderful amalgam of problems arise in this context, some have been addressed quite exhaustively, others are surprisingly novel! While the success of the Mars Rover project has demonstrated the mature capabilities of autonomous mobile robots, there has been relatively little work on sensor-based motion planning for manipulators. Many challenging tasks in personal robotics demand the integration of mobility and manipulation. A key aim of the workshop is to have precisely such a cross fertilization (surprisingly there has been very little if any interaction among the two groups) of ideas between researchers from the mobile robot domain and from manipulator robot domain. While there are common issues (for example, building an environment map) in the two domains, many of the underlying issues are complementary. For instance, localization error is a major problem in mobile robots, whereas, for manipulator arms, it is not. On the flip side, the kinematic complexity (dimensionality and structure of the configuration space) is an issue in the case of manipulator arms, but not for mobile robots. We hope that the workshop will provide a forum for enriching discussions while covering fundamental and key areas such as sensor-based fine and gross motion planning, route planning, exploration, visual servoing, position uncertainty, and behavioral based control.

*Speakers*
Ron Arkin *Georgia Institute of Technology*
Tucker Balch *Carnegie-Mellon University*
Howie Choset *Carnegie-Mellon University*
Nicola Ferrier *University. of Wisconsin, Madison*
Kamal Gupta *Simon Fraser University, Canada*
Seth Hutchinson *University of Illinois, Urbana-Champaign*
Ben Kuipers *University of Texas*
Sharon Labauch *Jet Propulsion Laboratory/CalTech*
Joel Burdick *Jet Propulsion Laboratory/CalTech*
Jon Leonard *Massachusetts Institute of Technology*
Vladimir Lumelsky *University of Wisconsin, Madison*
Hiroshi Noborio *Osaka Electro-Communication University, Japan*
Jim Ostrowski *University of Pennsylvania*
Angel P. del Pobil *University Jaume I, Spain*
Elon Rimon *Technion, Israel*
Farrokh Sharifi *Ryerson Polytechnic, Canada*
Rajeev Sharma *Pennsylvania State University*
Thierry Simeon *LAAS, CNRS, Toulouse, France*
Sebastian Thrun *Carnegie Mellon University*

**W9 FRIDAY 28 APRIL, 2000**
**Self-Organization in Robotics and Flexible Manufacturing**

*Organizer*
**Jens Starke** *University of Heidelberg, Institute of Applied Mathematics, Im Neuenheimer Feld 294, D-69120, Heidelberg, GERMANY,* starke@iwr.uni-heidelberg.de

The market requests a production with high variety and short delivery periods. To achieve this, new manufacturing processes with high flexibility and modularity are needed where promising strategies are self-organization approaches. The aim is to bring together researchers from several disciplines to discuss the opportunities of adapting self-organization approaches from nature to the field of robotics and manufacturing. Furthermore, it is planned to develop and define standard problems which focus and coordinate the work in this field and allow to compare several approaches. In addition, it will be discussed if mathematical methods can be adapted from physics of complex systems to robotics.

*Speakers*
Ronald Arkin *Georgia Institute of Technology, College of Computing, Atlanta, USA,* ronald.arkin@cc.gatech.edu
Hajime Asama *The Institute of Physical and Chemical Research (RIKEN), Wako-shi, JAPAN,* asama@cel.riken.go.jp
Toshio Fukuda *Nagoya University, Center for Cooperative Research in Advanced Science and Technology, Nagoya, JAPAN,* fukuda@mein.nagoya-u.ac.jp
Pradeep Khosla *Carnegie Mellon University, Robotics Institute, Pittsburgh, USA,* pkk@ices.cmu.edu
Peter Molnar *Center for Theoretical Studies of Physical Systems Clark Atlanta University, Atlanta, USA,* pmolnar@cau.edu
Jens Starke *University of Heidelberg, Institute of Applied Mathematics, GERMANY,* starke@iwr.uni-heidelberg.de
Andreas Stopp *Daimler Chrysler AG, Berlin, GERMANY,* andreas.stopp@daimlerchrysler.com
Kanji Ueda, Kobe University *Dept. of Mechanical Engineering, Kobe, JAPAN,* ueda@mech.kobe-u.ac.jp

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