

# 45<sup>th</sup> CDC Workshops

<b>WORKSHOP</b>	<b>ROOM</b>	<b>MORNING SESSION</b>	<b>AFTERNOON SESSION</b>
<b>New Developments in Point-Stabilization, Trajectory-Tracking, Path-Following, and Formation Control of Autonomous Vehicles</b>	Manchester A	8:40-12:30	13:30 – 17:35
<b>Model Predictive Control for Fast Nonlinear Systems: Existing Approaches, Challenges and Applications</b>	Manchester B	8:40 – 12:30	13:45 – 17:00
<b>High-Confidence Embedded Systems</b>	Manchester C	9:15 – 12:00	13:30 – 17:00
<b>Hybrid Systems Biology</b>	Manchester D	8:30 – 12:00	14:00 – 17:30
<b>Modeling, Optimization and Software in Air Traffic Management</b>	Manchester E	8:30 – 12:00	13:00 – 17:30
<b>Robust Hybrid Systems: Theory and Applications</b>	Manchester F	8:30 – 12:00	13:15 – 17:30

## 45<sup>th</sup> CDC Workshop 1

# New Developments in Point-Stabilization, Trajectory-Tracking, Path-Following, and Formation Control of Autonomous Vehicles

## Manchester A

### Organizers

#### **Pedro Aguiar**

Institute for Systems and Robotics, Instituto Superior tecnico, Portugal.

#### **Antonio M. Pascoal**

Institute for Systems and Robotics, Instituto Superior Technico, Portugal

#### **João P. Hespanha**

Center for Control, Dynamical Systems, and Computation, University of California, Santa Barbara, USA

### Schedule

- 08:40 - 08:45 Opening
- 08:45 - 09:30 **P. Morin** (INRIA) Trajectory tracking for nonholonomic and underactuated vehicles by the transverse function approach
- 09:30 - 10:15 **N. McClamroch** (The University of Michigan) Nonlinear Control Strategies for Aircraft Path Following
- 10:15 - 10:30 Break
- 10:30 - 11:15 **J. Hauser** (University of Colorado) Nonlinear Regulation for Motorcycle Maneuvering
- 11:15 - 12:00 **K. Morgansen**, (University of Washington) Geometric Methods for Modeling and Control of Shape-Actuated Underwater Vehicles
- 12:00 - 12:30 **A. Pedro Aguiar** (Institute for Systems and Robotics, IST) New Developments in Point- Stabilization and Path-Following
- 12:30 - 01:30 Lunch break
- 01:30 - 02:15 **K. Pettersen**, (Norwegian University of Science and Technology) Path following and formation control of autonomous marine vehicles
- 02:15 - 03:00 **A. Pascoal** (Institute for Systems and Robotics, IST) Coordinated path- following of multiple underactuated autonomous vehicles with communication constraints
- 03:00 - 03:15 Break
- 03:15 - 04:00 **I. Kaminer** (Naval Postgraduate School) Coordinated Control of Multiple UAVs for Time-Critical Applications
- 04:00 - 04:45 **F. Bullo** (UC Santa Barbara) Motion coordination for multi-agent networks
- 04:45 - 05:30 **J. Hespanha** (UC Santa Barbara) Motion coordination of a large number of vehicles
- 05:30 - 05:35 Closing

## 45th CDC Workshop 2

# Model Predictive Control for Fast Nonlinear Systems: Existing Approaches, Challenges and Applications

Manchester B

Organizer

**Rold Findeisen**

University of Stuttgart

Germany

### Schedule

- |             |   |
|-------------|---|
| 08:40-08:45 | Welcome + Overview  |
| 08:45-09:30 | Introduction and overview to NMPC for fast nonlinear systems  |
| 09:30-10:30 | A review of fast efficient numerical solutions methods for NMPC   |
| 10:30-11:00 | Coffee Break  |
| 11:00-11:45 | Real-time NMPC and moving horizon state estimation using the continuation method and GMRES including mechatronic examples       |
| 11:45-12:30 | A new real-time framework for NMPC of Continuous-Time systems with applications to chemical processes and manufacturing systems |
| 12:30-13:45 | Lunch Break   |
| 13:45-14:45 | The parameterized approach for fast NMPC  |
| 14:45-15:30 | Nonlinear MPC applied to vehicle dynamics control   |
| 15:30-16:00 | Coffee Break  |
| 16:00-16:45 | NMPC for fast automotive applications   |
| 16:45-17:00 | Wrap up, summary and outlook  |

## 45th CDC Workshop 3

# High-Confidence Embedded Systems

## Manchester C

### Organizers

**Erik Klavins**

University of Washington

**Richard Murray**

California Institute of Technology

### Schedule

- |             |  |
|-------------|--|
| 9:15-9:30   | <i>Verification and Validation in Engineered Systems: Key Challenges</i><br><a href="#">Eric Klavins</a>             |
| 9:30-10:00  | <i>Embedded Systems Verification and the DARPA Grand Challenge</i><br><a href="#">Richard Murray</a>                 |
| 10:00-10:30 | <i>Long Lived Systems via Model-Based Autonomy</i><br><a href="#">Brian Williams</a>                                 |
| 10:30-11:00 | <i>Coffee Break</i>  |
| 11:00-11:30 | <i>Hybrid Systems Verification</i><br><a href="#">Claire Tomlin</a>  |
| 11:30-12:00 | <i>System Level Control of the KIVA Automated Material Handling Systems</i><br><a href="#">Raffaello D'Andrea</a>    |
| 12:00-1:30  | <i>Lunch</i>   |
| 1:30-2:00   | <i>Formal Methods for Embedded Systems</i><br><a href="#">Paulo Tabuada</a>  |
| 2:00-2:30   | <i>Robustness for Embedded Systems</i><br><a href="#">George Pappas</a>  |
| 2:30-3:00   | <i>Embedded Communication Protocols</i><br><a href="#">Eric Klavins</a>  |
| 3:00-3:30   | <i>Coffee Break</i>  |
| 3:30-4:00   | <i>Sum of Squares Optimization in the Analysis and Synthesis of Control Systems</i><br><a href="#">Pablo Parrilo</a> |
| 4:00-4:30   | <i>Robustness and Fragility in Engineered Systems</i><br><a href="#">John Doyle</a>                                  |
| 4:30-5:00   | <i>Panel Discussion</i><br><b>Group</b>  |

## 45th CDC Workshop 4

# Hybrid Systems Biology

Manchester D

Organizers

**Giancarlo Ferrari-Trecate**

Dip. di Informatica e Sistemistica,  
University of Pavia

**John Lygeros**

Automatic Control  
Laboratory, ETH Zurich

**Schedule**

- 8:30 - 9:15 **J. Lygeros** (ETH, Zürich): "An overview of the use of hybrid models in biochemical networks"
- 9:15 - 10:00 **M. Chavez** (University of Stuttgart) & **E. Sontag** (Rutgers University): "Piecewise linear systems and asynchronous methods for robustness analysis of Boolean models of gene/protein networks"
- 10:00 - 10:45 **C. Tomlin** (U.C. Berkeley & Stanford University): "Using hybrid system analysis to help decode protein regulatory networks"
- 10:45 - 11:15 Break
- 11:15 - 12:00 **J. Hespanha** (U.C. Santa Barbara): "Stochastic hybrid models of biochemical processes"
- 12:00 - 14:00 Lunch
- 14:00 - 14:45 **Z. Lygerou** (University of Patras): "Stochastic hybrid models for DNA replication"
- 14:45 - 15:30 **G. Batt** (Boston University): "Validation of genetic regulatory network models"
- 15:30 - 16:00 Break
- 16:00 - 16:45 **G. Ferrari-Trecate** (University of Pavia): "Data-driven hybrid modeling of genetic regulatory networks"
- 16:45 - 17:30 **C. Belta** (Boston University): "Automatic tuning of synthetic gene networks"

## 45th CDC Workshop 5

# Modeling, Optimization and Software in Air Traffic Management

Manchester E

Organizer

**Banavar Sridhar**

NASA Ames Research Center

### Schedule

8:30 – 8:45	Introduction ( <b>Banavar Sridhar</b> )
8:45 – 9:45	Overview ( <b>Banavar Sridhar</b> )
9:45 – 10:45	Linear Models (30 mins <b>PK Menon</b> , 30 mins. <b>Alex Bayen</b> )
10:45 – 11:00	Coffee Break
11:00 – 12:00	Separation assurance ( <b>Claire Tomlin</b> )
12:00 – 13:00	Lunch Break
13:00 – 14:00	FACET ( <b>Kapil Sheth</b> )
14:00 – 14:45	CARAT# ( <b>PK Menon</b> )
14:45 – 15:30	Berkeley Eulerian Toolbox ( <b>Alex Bayen</b> )
15:30 – 15:45	Coffee Break
15:45 – 16:45	Panel Discussion (led by <b>Dave Knorr</b> )
16:45 – 17:30	NASA Research Announcements ( <b>Banavar Sridhar</b> )

## 45th CDC Workshop 6

# Robust Hybrid Systems: Theory and Applications

Manchester F

Organizers

**Andrew R. Teel**

University of California  
Santa Barbara, USA

**Ricardo G. Sanfelice**

University of California  
Santa Barbara, USA

## Schedule

- 8:30 - 10:20    Module 1: Modeling and Solutions to Hybrid Systems.
- 10:20 - 10:35    Coffee break.
- 10:35 - 12:00    Module 2: Engineering Motivation for the General Model.
- 12:00 - 1:15    Lunch break.
- 1:15 - 3:30    Module 3: Stability Analysis.
- 3:30 - 3:45    Coffee break.
- 3:45 - 5:30    Module 4: Hybrid Control.