Final Program & Digest

2012 12th International Conference on Control, Automation and Systems (ICCAS 2012)

October 17 (Wednesday) - 21 (Sunday), 2012

ICC Jeju, KOREA

Organized by

Institute of Control, Robotics and Systems (ICROS)

Technically Co-Sponsored by

IEEE Industrial Electronics Society
IEEE Robotics and Automation Society
IEEE Control Systems Society
The Society of Instrument and Control Engineers (SICE)
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V. Workshop and Tutorial

A. Mini-workshop on Nonlinear Synchronization

- Date & Time : October 18 (THU) 13:00~15:00
- Room : 302
- Presentation : Korean
- Admission : free of charge for ICCAS 2012 participants
- Program

13:00~13:40 - Synchronization of Chaotic FitzHugh-Nagumo Neuron Models
Prof. Keum-Shik Hong / Pusan National Univ., Mechanical Engineering Department

13:40~14:20 - Recent results on the complete synchronization of Kuramoto model on networks
Prof. Seung-Yeal Ha / Seoul National Univ., Department of Mathematical Sciences

14:20~15:00 - Synchronization, Strong Coupling, and Robustness
Prof. Hyungbo Shim / Seoul National Univ., Electrical Engineering Department

B. Tutorial

◈ Tutorial 01

- Topic : Filtering Theory and Applications to Integrated
  필터링 이론 및 복합항법 응용
- Organizer : Prof. Chan Gook Park (Seoul National University)
- Presentation : Korean
- Program

The principal goal of this tutorial is to provide an introduction to the basic principle and applications of Linear Kalman filter, Unscented Kalman filter and Particle filters to integration of GPS (Global Positioning System) with Inertial Navigation Systems and Dead Reckoning Systems. Fundamental concept on filtering technique with detailed mathematical development will be introduced, so that one can build up solid background on the basics of Kalman filter as well as general filtering theory. Considering the importance of Kalman filtering in the practicing areas of GPS/INS integration, practical applications of the Kalman filter to advanced car navigation are also presented following the basic theory. The workshop will deliver highly useful knowledge and experience for graduate students working on related research, scientists of government institutes, and field engineers being involved with practical projects. The one-day tutorial consists of three parts. In the first session, introduction and mathematical developments of the linear Kalman filter theory is scheduled. In the second session, more advanced filters such as the unscented filter and the particle filters will be discussed. In the last session, various useful aspects of GPS/DR integration will be discussed for practical applications.

◈ Tutorial 02

- Topic : Model Predictive Control: On-line optimization based approach vs. explicit approach
- Room / Time / Day : #302, 8:30-17:00 (Oct. 20, 2012)
- Organizer : Prof. Jay H. Lee (KAIST) / Prof. E. N. Pistikopoulos (Imperial College, London)
- Fee : Student 180,000Won, Regular 250,000Won
- Presentation : English
- Program

The principal goal of this tutorial is to provide an introduction to the basic principle and applications of linear and nonlinear model predictive control. The first half of the tutorial will

present the traditional approach of employing on-line optimization. Stability and optimality in closed loop will be discussed. Methods to speed up the on-line optimization for problems requiring fast sampling rates will be discussed. The second half of the tutorial will present an explicit MPC approach in which multi-parametric programming is used to parameterize the MPC control law explicitly offline. The main advantage of explicit MPC is that the on-line optimization is replaced by a table lookup, which can be considerably faster. Several applications of explicit MPC will be presented.

08:30 ~ 10:00: Lecture 1 (Linear MPC)
10:30 ~ 12:00: Lecture 2 (Nonlinear MPC)
13:30 ~ 15:00: Lecture 3 (Explicit MPC Part I)
15:30 ~ 17:00: Lecture 3 (Explicit MPC Part II)

◈ Tutorial 03

- Topic : The operational space control framework
  로봇 팔 제어 방법
- Room / Time / Day : #301B, 8:30-12:10 (Oct. 20, 2012)
- Organizer : Prof. Jaeheung Park (Seoul National University)
- Fee : Student 90,000Won, Regular 120,000Won
- Presentation : Korean
- Program

The operational space control framework provides a means to direct task space control of the robot by fully utilizing the robot dynamics without using inverse kinematics. The operational space or task space is typically defined to be the position and orientation of the end-effector. More generally, it can be defined to be the position and orientation of any link of the robot or any other quantities that can be mathematically described such as the center of the mass of the system. Understanding of the operational space control framework gives you not only the knowledge about task-oriented control framework but also the insight about the robot dynamics. The lecture will first go over the basic robotics material - kinematics and joint space dynamics. Then, the operational space (task space) dynamics and control will be presented. Finally, the task-posture decomposition approach using task redundancy and hybrid position-force control will be discussed.

08:30 ~ 10:10: Lecture 1 (Kinematics and dynamics in operational space)
10:30 ~ 12:10: Lecture 2 (The operational space control framework and task-posture decomposition)

◈ Tutorial 04

- Topic : Robot Vision: Principles and Applications
  로봇비전: 원리와 응용
- Room / Time / Day : #301B, 13:30-17:00 (Oct. 20, 2012)
- Organizer : Prof. In So Kweon (KAIST)
- Fee : Student 90,000Won, Regular 120,000Won
- Presentation : Korean
- Program

Robot vision gives robots the ability to perceive the external world in order to perform tasks such as navigation, visual tracking, object detection and recognition. Most robot vision algorithms run in four steps image acquisition, low-level image processing, mid-level image matching, and high-level information extraction. This tutorial introduces the basic principles of robot vision and the state-of-the-art technologies including some of the real-world applications.