Summit 2

TA02
Model Reduction II

Chair: Repperger, Daniel W. Air Force Research Lab.
Co-Chair: Dahleh, Munther A. Mass. Inst. of Tech.

09:15
Coarse gain recurrent integrator model for sensorimotor cortical command generation 1736
Ayaso, Ola Massachusetts Inst. of Tech.
Massaquoi, Steve G. Massachusetts Inst. of Tech.
Dahleh, Munther Massachusetts Inst. of Tech.

Abstract: The coarsely sampled inverse Jacobian, or ``Coarse Gain'' Recurrent Integrator Command Generator (CGRICG) model is a preliminary proposal for motor command generation in the sensorimotor cortex during unloaded horizontal reaching movements based significantly upon implicit coordinate transformation. The core of the model is an integrator that in negative feedback configuration performs approximate differentiation of a central movement trajectory command. Together with an accurate forward kinematic model and a distribution and scaling network that is only coarsely tuned in relation to movement direction, the feedback configuration achieves inverse kinematic transformation implicitly throughout the workspace. Simulations of the CGRICG directing motion of a six-muscle, two-joint arm model reproduce gross kinematic features of human and primate arm movement as well as plausible neurophysiological signals in internal sensorimotor cortical neurons. The CGRICG model suggests that cortical network connection strengths may be adapted to improve straightness of motion without affecting final target location.

09:35
Robustness analysis of the heat shock response in E. coli 1742
El-Samad, H. Iowa State Univ.
Khammash, M. Iowa State Univ.
Kurata, H. Kyushu Inst. of Tech.
Doyle, J. California Inst. of Tech.

Abstract: The bacterial heat shock response refers to the mechanism by which bacteria react to a sudden increase in the ambient temperature of growth.The consequences of such an unmediated temperature increase at the cellular level is the unfolding, misfolding, or aggregation of cell proteins, which threatens the life of the cell. Cells respond to the heat stress by initiating the production of heat-shock proteins whose function is to refold denatured proteins into their native states. The heat shock response, through the elevated synthesis of molecular chaperones and proteases, enables the repair of protein damage and the degradation of aggregated proteins. In a previous work [1], we have devised a dynamic model for the heat shock response in E. coli. In the present paper, we provide a thorough discussion of the dynamical nature of this model. We use sensitivity analysis and simulation tools to illustrate the remarkable efficiency, robustness, and stability of the heat shock response system.

09:55
Numerical algorithm for model reduction of polytopic uncertain linear systems 1748
Wu, Fen North Carolina State Univ.
Jaramillo, Juan J. North Carolina State Univ.

Abstract: In this paper we study a numerical algorithm for model reduction problem of polytopic uncertain linear systems. The polytopic system has its state-space data contained in a convex polytope, a situation that often arises. The problem we are trying to solve is to find a lower order polytopic uncertain linear system with a guaranteed induced L_2 norm error. A sufficient solvability condition was provided in terms of LMIs with one extra coupling rank constraint, which generally leads to a non-convex feasibility problem. To deal with this problem, a cone complementarity algorithm is developed, although only local convergence is guaranteed.

10:15
On the properties of frequency weighted balanced truncation techniques 1753
Sreeram, V. Univ. of Western Australia

Abstract: In this paper, we derive some interesting properties of three frequency weighted balanced truncation techniques: Enns technique, Wang et al's technique, and Lin and Chiu's technique.

10:35
A system-theoretic formulation of the bunch train cavity interaction 1755
Schwartz, Charles Northwestern Univ.
Haddad, Abraham H. Northwestern Univ.

Abstract: The bunch train cavity interaction is an accelerator physics problem, for which a system-theoretic model is lacking. A form of modal analysis has been used to characterize the system dynamics, and this model has been used for control system design. Correspondingly, control design has been done using input-output classical frequency-domain-based control, including several nested loops. Several shortcomings of this control-design method are highlighted, all of which are remedied by a new time-domain, system-theoretic model developed herein. The new formulation is a periodic, discrete-time system, amenable to state-space control-design methods.

10:55
Control oriented models for TWC-equipped spark ignition engines during the warm-up phase 1761
Fiengo, Giovanni Univ. di Napoli Federico II
Glielmo, Luigi Univ. del Sannio
Santini, Stefania Univ. di Napoli Federico II
Serra, Gabriele Magneti Marelli Powertrain Div.

Abstract: This paper introduces new phenomenological models of the spark ignition engine combustion and the three-way catalyst, able to describe the dynamic behaviors of the system in different operating modes, including the thermal transient, and being sufficiently simple for control synthesis. The models have been validated on experimental data.

Summit 3

TA03
Nonlinear Adaptive Control

Chair: Leonessa, Alexander Florida Atlantic Univ.
Co-Chair: Qu, Zhihua Univ. of Central Florida

09:15
New direct adaptive active noise control algorithms in case of uncertain secondary path dynamics 1767
Kouno, Toshikazu Keio Univ.
Ohmori, Hiromitsu Keio Univ.
Sano, Akira Keio Univ.

Abstract: Almost all adaptive feedforward control algorithms for active noise control require a precise model of the secondary path dynamics from the control loudspeaker to the error and reference microphones. This paper is concerned with new direct adaptive algorithms which will be applicable even when the secondary path dynamics are uncertain or unknown. In the first approach, the control algorithm consists of a robust adaptive feedforward control algorithm and robust feedback control scheme permitting bounded