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Room 311, Lanbai Building, Academy of Math. & Sys. Sci., CAS



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Title: Variations on the LQG Paradigm and the Emerging Subtleties

Abstract

One of the most celebrated paradigms and results in control that has dominated the field since the middle of the last century involves the linear-quadratic-Gaussian (LQG) optimal control problem, which features several appealing properties, such as (i) separation of estimation and control, (ii) certainty equivalence, and (iii) neutrality, which are also interrelated. With the emergence of remote control applications, where the plant-to-control and control-to-plant communications are conducted over a heterogeneous network, or applications that involve distributed agents over large networks, several of the governing assumptions that lead to the LQG paradigm are challenged, and non-traditional and non-standard constraints are being imposed on control designs, prompted by constraints on power usage and limits on available resources. A research question that comes up then is the robustness of the LQG optimal controller and its appealing properties (in the structural sense) to variations around the standard paradigm, brought about by considerations such as: (i) limitations on memory, (ii) limitations on computation and communication capabilities, (iii) decentralization, (iv) sporadic failure of channels that connect sensors to controllers and controllers to plants, (v) limitations on the frequency of interactions (of the controller) with the sensors and the plant, (vi) operating in a hostile environment where disturbances are controlled by adversarial agents, (vii) lack of cooperation among multiple control units, and (viii) lack of a common objective shared by multiple control stations. Any one of these variations actually leads to a non-standard control problem, where the LQG controller ceases to be an acceptable design under any reasonable performance measure.

This talk will provide an overview of the issues and subtleties that arise as a result of variations around the LQG model, of the types above. It will also discuss a number of non-standard solution techniques for non-neutral control, and identify the emerging challenges in this general area.