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Non-Neutral Decision Making in Control and Dynamic Games

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Abstract

Availability of accurate and timely information on the state of a dynamic system or on the uncertain environment where the system to be controlled resides has always been an important factor in the performance of controller design. Roughly speaking, the *more* is communicated to a controller the *better* is the performance it delivers. Driven by this dictum, research in control of uncertain systems has addressed for many decades the problems of first how to reshape (for example, encode) the available information within given constraints, and then how to process it (decode or filter) so that it will be of utmost value to the controller. There are, however, also the critical questions of whether and how the control itself can be used to improve the quality of this information (the *dual* or *triple* role of control) toward in turn possibly improving its own performance. These issues become more pronounced and complex in game situations, where it could even happen that enhancement of the quality of information through decisions or actions would be detrimental to a player. Decision-making systems, be they control or game related, where the *quality* of the information exchanged over communication channels is affected by decisions or actions are known as *non-neutral*. This phenomenon brings in inherent difficulties to control and game problems in the construction of optimal controllers, or equilibrium policies in stochastic games. Even though *non-neutrality* is almost half-a-century old today as a concept, the question of how to cope with the tradeoffs that arise in this context is still in search of a universally applicable satisfactory answer.

This plenary talk will provide an overview of the issues underlying the interplay between communication and decision making in optimal control and non-cooperative game problems (with Nash equilibrium as the solution concept for the latter). It will particularly dwell on systems with multiple agents (players) with decentralized, non-classical information.