



Department of Electrical and Computer Engineering Colloquium

Robust Maximum Principle and its Applications to LQ-Differential Games and Stochastic Control

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Abstract.

This talk deals with the version of the *Robust Maximum Principle* in the context of Multi-Model Control Optimization formulated as the min-max Bolza problem. The cost function contains a terminal term as well as an integral one. Finite and infinite horizons as well as terminal sets are considered. The necessary conditions of optimality are derived for the class of multi-model systems given by an ordinary differential equation with parameters from a given finite or/and compact sets. Each parameter combination corresponds to one of possible scenarios for further dynamics of the system. The problem consists in the control design providing *a good behavior* (in the min-max sense) for a given class of multi-model system. Here *maximum* is taken over the set of possible scenarios (or possible models) and *minimum* - over a set of admissible controls.

It is shown that **the design of the min-max LQ-optimal controller is reduced (in the case of a finite model set) to a finite-dimensional optimization problem given at the corresponding simplex set containing the weight parameters to be found.** The robust optimal control may be interpreted as a *mixture* (with some optimal weights) of the controls which are optimal for each fixed parameter value that justifies, as an example, the fuzzy control implementation for such sort of problems with quadratic criteria. A numerical procedure for the corresponding weights adjustment is discussed. The application of this method is related to LQ-differential multi-model games and to stochastic systems with models governed by Ito-type differential equations with controllable noise-term.

Alexander S. Poznyak graduated from Moscow Physical Technical Institute (MPhTI) in 1970. He earned Ph.D. and Doctor Degrees from the Institute of Control Sciences of Russian Academy of Sciences in 1978 and 1989, respectively. From 1973 to 1993 he worked at this institute as researcher and leading researcher, and in 1993 he accepted a position of full professor (3-E) at CINVESTAV of IPN in Mexico. Currently he is the chairman of the Automatic Control Department. He has supervised 23 PhD theses (15 in Mexico). He has published more than 120 papers in international journals and 9 books. He is Associated Editor of "Iberoamerican Int. Journal on Computations and Systems". He was also Associate Editor of CDC, ACC and Member of Editorial Board of IEEE CSS. He is a member of the Evaluation Committee of SNI (Ministry of Science and Technology) responsible for Engineering Science and Technology Foundation in Mexico.