23rd IFIP TC7 Conference on Modelling and Optimization

Invited Session Proposal

Session title:

MODELLING, CONTROL AND OPTIMIZATION OF DYNAMICAL
SYSTEMS: THEORY AND APPLICATIONS TO BIOMEDICINE

Organizers:

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Number of speakers: about 25

In the proposed session we are bringing together researchers from various areas in dynamical systems, optimization and optimal control theory with researchers from application oriented disciplines of mathematical modelling with the intent of providing a basis for an exchange of ideas possibly preparing the ground for future collaborations. The talks in the proposed session provide a diversity of view-points of new developments in the area of control and optimization of nonlinear systems both from the type of methods used (non-smooth analysis, functional analysis, differential-geometry, variational and geometric methods, numerical procedures) and the application oriented problems considered (with a concentration in biomedical areas, but also from other disciplines in the sciences and engineering).

Among the more theoretical contributions, some emphasis will be put on results about sufficient conditions for optimality including among others dynamic programming related approaches, regularity properties of optimal solutions, and results establishing the optimality of singular controls in minimum time problems. In one of the talks these issues will be directly linked with the motion planning problem for an underwater vehicle using singular controls; in another talk these theories will be applied to establish optimal protocols for the administration of angiogenic inhibitors in a cancer treatment approach.

Generally, throughout the presentations connections of more theoretical results with application oriented problems are sought and enhanced with topics ranging from the collection of biomedical data to the construction of mathematical models and their analysis with tools of dynamical systems, control theory and optimization. This will include models describing cancer treatments from traditional ones like radiotherapy or chemotherapy to novel treatments like anti-angiogenesis or immunotherapy. Analysis of models describing treatments of various viral infections and epidemiology of HIV will also be presented. Another area of the proposed session addresses genetic models. The talks include the design of models for signaling pathways which form the fundamental genetic regulatory systems that govern the processes on a molecular level inside any living cell. Also the modelling of morphological transformations of complex cellular systems interacting with local environment will be addressed.