Open Invited Track on **Control for Computing Systems**

Eric Kerrigan, Imperial College London, UK (e.kerrigan@imperial.ac.uk)
Eric Rutten, Univ. Grenoble Alpes, Inria, CNRS, Grenoble INP, LIG, F-38000 Grenoble France (eric.rutten@inria.fr)

Recently, in computer science, the notion of reconfigurable or autonomic computing systems has been introduced and defined as computing systems that can reconfigure themselves through feedback loops. The need for adaptivity is motivated by important issues in resource management, e.g. energy, computation, memory, communication bandwidth, processor size and time. Reconfiguration can also support the management of aspects in quality of service, e.g. levels of precision in computing, urgency of treatment and graceful degradation. Adaptation is also important for dependability and fault tolerance, e.g. controlling migrations in response to loss of a processor. There is therefore a need for well-founded methods, models and techniques for the design of controllers that can give guarantees on the behavior of the controlled computing systems. Currently, the design of the controllers is largely done in an ad-hoc programmatic fashion, but there is a growing interest in using control theory for their design, in order to provide designers with a framework to master the complexity of designs, and with guarantees w.r.t. their correctness or optimality. Such feedback loops can be designed using continuous control techniques when they concern quantitative aspects. Another significant approach addresses synchronization and coordination problems using discrete control techniques.

Computing systems constitute a novel application domain for control theory, which is different from the classical targets of physical systems, with specificities in the nature of the entities to be controlled (CPUs, memory, communication, software components, tasks and services, migrations), the nature of dynamical runtime variations and perturbations (request flows, value-dependent behaviors, supply, fault-tolerance), or functionalities to be fulfilled.

Many control problems in computing do not obviously or naturally lend themselves to classical, regulator based approaches that can be solved using standard linear control theory from introductory textbooks. Most problems are often most naturally posed as constraint satisfaction or optimization problems. Though first-principles models are seldom available, in many cases data can be relatively easy to come by in order to identify or validate models. These characteristics present interesting challenges and opportunities for the development and application of suitable control methods.

The purpose of this open invited track is to group contributions about the control of adaptive and reconfigurable computing systems, especially involving models and algorithms related to control theory. This track targets computing systems as an application domain of various approaches to control design, e.g. Control Design, Nonlinear Control, Optimal Control, Robust Control, Discrete Event and Hybrid Systems. On the one hand this track will introduce this interesting new application domain, which has a very wide and lively potential, and highlight the differences to traditional applications of control theory. On the other hand, this track will bring together researchers working in this area that, up to now, have been working separately on this topic because of the lack of an established community.