Series Expansion based Numerical Approaches for the Analysis and Optimization of Markovian Systems

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Markovian systems are omnipresent as models for discrete event dynamic systems. In the past decade, Taylor series expansion based techniques have become an important tool for the analysis and optimization of Markovian systems, with an emphasis on perturbation analysis. The specific characterization of this line of research is that the operator-based language for modelling and analysis of Markovian systems is made fruitful for numerical purposes. Thereby, this research establishes a link between simulation-based perturbation analysis and optimization of Markovian systems, and the classical matrix-analytic approach to perturbation analysis (which dates back to Schweitzer's pioneering paper of 1968). Recently, this research has gained much impetus from the fact that it is in many cases possible to control the numerical error introduced by using a series expansion approximation. Two main lines of research emerged from this: (i) One uses the expansion technique as a mathematical tool in order to establish matrix-norm bounds on the effect of a perturbation, and (ii) one computes bounds for the remainder of the series expansion and approximates the performance by means of a finite order polynomial with established error margin. Both approaches have shown their merits in numerous applications.

The purpose of this special session is twofold. It will bring together researchers working in this area, and create a forum for introducing this interesting emerging research field to a wider audience.

The topics of the special session, always with reference to numerical approaches based on series expansion and matrix bounding techniques include:
- optimization techniques;
- perturbation bounds;
- performance analysis via functional approximations.

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