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MS6

Computational and Numerical Challenges in Semiconductor Process Simulation

Semiconductor process simulation enables to predict critical manufacturing steps of semiconductor devices and circuits. In particular, it allows for so-called structure prototyping used in the critical exploratory phases of new semiconductor technologies. The ever-ongoing reduction of feature sizes and the required move towards increasingly intricate device structures requires efficient methods to enable fast, accurate, and stable modeling solutions. This is particularly challenging for necessary three-dimensional modeling approaches due to the involved computational effort and the limited acceptable simulation run-times, dictated by the fast-pacing progress in electronics. In this talk, current challenges in semiconductor process simulation, with a focus on computational and numerical aspects, will be discussed along with suggested approaches to tackle those. Among the topics are high performance visibility computation for plasma etching, three-dimensional growth-rate modeling for silicon carbide oxidation, parallel level set re-distancing for surface tracking, and efficient spatial discretizations for surface representations. The talk will also show the inter-disciplinary nature of the involved topics, enabling to introduce synergistic interfaces to other fields of research. The financial support by the Austrian Federal Ministry of Science, Research and Economy and the National Foundation for Research, Technology and Development is gratefully acknowledged.

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MS7

Walk-Based Centrality and Communicability Measures: Algorithms and Applications

In this talk I will review some network centrality and com-

municability measures based on walks. These measures can be given an elegant closed form in terms of functions of the adjacency matrix. I will introduce the notion of total communicability of a network as a measure of network connectivity and robustness and show that it can be computed very quickly even for large graphs. Finally, I will discuss efficient edge modification strategies (including edge removal, addition, and rewiring) that can be used to obtain networks with desirable communicability properties. The talk is based on recent work in collaboration with Christine Klymko (LLNL) and Francesca Arrigo (Strathclyde).

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MS7

Multilevel Model Reduction for Dynamic Power Grid Networks

An electric power grid system can be described by a system of differential-algebraic equations defined on a graph. A relevant task for the power grid community is to develop accurate model reduction for these systems, especially given the large size and stochasticity of the emerging grid. In this talk, we will look at multi-level approaches to constructing the reduced model. The basis of these approaches is the information contained in the weighted graph Laplacian generated by the admittance matrix of the grid. We describe this basis and examine some subtle challenges that these multi-level approaches face in order to achieve accurate simulation of dynamical power grid systems.

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MS7

Dynamic Processes Over Information Networks: Representation, Modeling, Learning and Inference

Large-scale and high resolution data from dynamic processes over networks are becoming increasing available nowadays from online social platforms, such as Twitter and Facebook. Such data provide great opportunities for understanding and modeling both macroscopic (network level) and microscopic (node-level) patterns in human dynamics. Such data have also fueled the increasing efforts on developing methods to address the challenges arising from understanding, predicting, controlling and distilling knowledge from these dynamic processes over networks, and answer query such as "who will do what and when?" To tackle these challenges, I will present a framework based on point processes for representing and modeling such data, and performing learning, inference and control over dynamic processes over networks.

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MS7

Influence Prediction for Continuous-Time Information Propagation on Networks Using Graph-Based Fokker-Planck Equation

We consider the problem of predicting influence, defined as