Abstract:
The numerical solution of complex physical problems typically requires the setup of appropriate PDE models and of accurate numerical methods. • Often, the numerical problem is so large that a reduction of its complexity becomes mandatory. This can be achieved by a manifold strategy with the attempt of simplifying the original mathematical model, devising novel numerical approximation methods, and developing efficient parallel algorithms that exploit the dimensional reduction paradigm. • In different circumstances, especially in control and optimization problems for parametrized PDEs, reduced order models, such as the reduced basis method and the simplified shape parametrization method, can be used to alleviate the computational complexity. • After introducing the proper mathematical setting, in this presentation a variety of representative applications to blood flow modeling, environmental modeling, and sports design will be illustrated.