Special Guest Lectures

Reduced Models You Can Believe In

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Abstract:
The development and application of models of reduced computational complexity is used extensively throughout science and engineering to enable the fast/real-time/subscale modeling of complex systems for control, design, or prediction purposes of multiscale problems. Such models, while often successful and of undisputed value, are, however, often heuristic in nature and the validity and accuracy of the output is often unknown. This limits the predictive value of such models. In this talk we will discuss recent and ongoing efforts to develop reduced basis methods for which one can develop a rigorous a posteriori theory. The approach aims at formulating reduced models for parameterized linear partial differential equations such as Maxwell's equations. We will outline the theoretical developments of certified reduced basis methods, discuss an offline-online approach to ensure computational efficiency, and emphasize how an error estimator can be exploited to construct an efficient basis at minimal computational off-line cost. The discussion will draw on examples based both on differential and integral equations formulations. The performance of the certified reduced basis model will be illustrated through several examples to highlight the major advantages of the proposed approach as well as key open challenges in the current approach. This is work done in collaboration with Y. Chen (UMass Dartmouth), B. Stamm (UC Berkeley), Y. Maday (Paris VI), and J. Rodriguez (University of Santiago),

Speaker's Bio:
Professor Hesthaven is Professor of Applied Mathematics, Director of the Center for Computational and Visualization (CCV) and Associate Director of the newly created NSF Institute for Computational and Experimental Research in Mathematics at Brown University. He received an M.Sc.(1991), Ph.D(1995), and Dr.Techn(2009), all from Technical University of Denmark (DTU). Following graduation in August 1995, he was awarded an NSF Postdoctoral Fellowship and was appointed Visiting Assistant Professor in the Division of Applied Mathematics at Brown University. In 1999, he was appointed Assistant Professor of Applied Mathematics, with promotion to Associate Professor in 2003 and Professor of Applied Mathematics in 2005. Since 2007 he is also Adjunct Professor at the Technical University of Denmark. His primary research activities has focused on the development, analysis, and application of high-order accurate computational methods for solving time-dependent partial differential equations. A particular emphasis has been on problems derived from electromagnetics. He has also worked extensively in the development of efficient absorbing layers, the development of efficient methods for uncertainty quantification for complex problems, and reduced complexity models. He has published 80+ journal papers and two research monographs, has received several awards for his research and teaching, and acts as a consultant for several companies.

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