COLUMBIA | ENGINEERING
The Fu Foundation School of Engineering and Applied Science

Distinguished Colloquium in Interdisciplinary & Applied Mathematics

Bjorn Engquist

University of Texas at Austin

"Computational Multiscale Modeling"

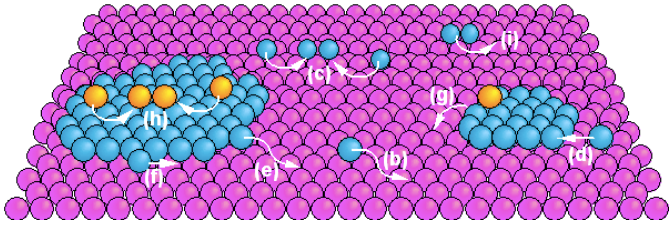

Image: Continuum - kinetic Monte Carlo coupled simulation of epitaxial growth for semiconductor production

In multiscale processes different phenomena interact on different scales in time and space. Computer simulations of such processes are challenging since the smallest scales should be accurately represented over domains that cover the largest scales. This results in a very large number of unknowns and prohibitingly long computing times. We will briefly discuss analytical techniques and then focus on numerical multiscale methods, which have been developed to overcome this difficulty, in particular, the Heterogeneous Multiscale Method (HMM). It is a computational framework focusing on the larger scales that only uses fine scale simulations locally. We will illustrate these technologies by applications to continuum and atomistic mechanics. The mathematical background from homogenization, averaging and information theory will be described. We will also see how parallel in time algorithms can be used for handling multiscale dynamical systems. The, so-called, parareal method can overcome the natural obstacle of causality for parallelization.

Biography: Bjorn Engquist received his Ph.D. in numerical analysis from Uppsala University in1975. He has been professor of mathematics at UCLA, and the Michael Henry Stater University Professor of Mathematics and Applied and Computational Mathematics at Princeton University. He was director of the Research Institute for Industrial Applications of Scientific Computing and of the Centre for Parallel Computers at the Royal Institute of Technology, Stockholm. At Princeton University, he was director of the Program in Applied and Computational Mathematics and the Princeton Institute for Computational Science.

Engquist is a member of the American Academy of Arts and Sciences, the Royal Swedish Academy of Sciences, the Royal Swedish Academy of Engineering Sciences, and the Norwegian Academy of Science and Letters. He was a Guggenheim Fellow, received the first Society for Industrial and Applied Mathematics Prize in Scientific Computing, the Henrici Prize, the Birkhoff Prize in Applied Mathematics, and the ICIAM Pioneer Prize.

Engquist came to The University of Texas at Austin in 2004, where he holds the Computational and Applied Mathematics Chair I, and is director of the ICES Center for Numerical Analysis. Engquist's research focuses on development and analysis of numerical methods for differential equations.

His earlier work includes the development of absorbing boundary conditions, homogenization theory and nonlinear high-resolution schemes for fluid dynamics. He is presently working on computational multi-scale methods and fast algorithms for wave propagation with applications in seismology.

Thursday, March 22, 2018

2:45 pm, 545 Mudd
500 West 120th Street
(Refreshments in 200 Mudd at 4:00 PM)