Matrix Computations & Scientific Computing Seminar

Organizer(s): James Demmel & Ming Gu

Wednesday, 11:00am–12:00pm, 380 Soda

Feb. 10 **Panayot S. Vassilevski**, Center for Applied Scientific Computing, Lawrence Livermore National Laboratory,
Multigrid and Algebraic multigrid: main principles, definitions, algorithms and applications

We will give an introduction to multigrid methods (or MG) for solving systems of (linear) algebraic equations. We will first give a motivation why the method has the potential to be of optimal order, namely, that it can be viewed as a (recursive) "divide and concur" algorithm. Then, we will introduce the main definitions and algorithms as well as we will summarize some basic theoretical results.

In the second part, we will focus on the algebraic version of the method (or AMG). The latter refers when the hierarchy of vector spaces needed to define a MG is constructed by the user in a matrix (operator) dependent way. In a sense, the AMG can be viewed as an "inverse" problem and as such it is "ill-posed", that is, many hierarchies of coarse spaces can be constructed so that they produce equally good (or bad) multigrid methods. We will focus on one AMG approach suitable for discretized partial differential equations on unstructured meshes. Finally, we will mention a dual use of AMG, namely, we will demonstrate how to use AMG approaches to construct new discretization (upscaling) spaces with high accuracy.

Panayot's talk consists of two parts: the first part is on Feb. 10 and is a basic survey of the field and the second part is on Feb. 17 and is on more recent development. All graduate students who are interested in scientific computing are encouraged to attend.