TEMPLE UNIVERSITY
Department of Mathematics

Applied Mathematics and Scientific Computing Seminar

Room 617 Wachman Hall

Wednesday, 23 April 2014, 4:00 p.m.
(tea and social at 3:45)

Multigrid and Algebraic multigrid: main principles, definitions, algorithms and applications

by Panayot S. Vassilevski

Lawrence Livermore National Laboratory

Abstract. 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 conquer" 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.