Math 419 • Linear Analysis • Summer 2005

Linear Analysis of Continuous & High-Dimensional Systems

Linearity, as first encountered in the algebra of vectors and matrices, provides the foundation for many other branches of mathematics. This course provides an introduction to two directions that directly follow from the ideas of linear algebra. The first is the classical extension to function spaces, and is presented within the specific context of Fourier analysis. Expansions upon this development naturally lead to the theories of orthogonal polynomials, Hilbert spaces and linear operators. These ideas will be investigated mainly from the perspectives of classical real analysis, but will also include concrete illustrations using elementary numerical computing. The second is the modern development of large-matrix algorithms, many of which are based upon well-established principles of linear operator theory, and are now made feasible by advances in computational speed and memory. Examples include the fast Fourier transform, the singular value decomposition, and Krylov subspace methods.

In this fourth-year course, the lectures will invoke aspects of both rigorous analysis and elementary numerical computing. Computer visualization will be an important accompaniment to the lectures and assigned work. The rudiments of numerical computing and graphics will be introduced through the use and modification of downloadable Matlab scripts.

Prerequisites are linear algebra (MATH 232) and analysis (MATH 320). Background familiarity with elementary differential equations (MATH 310 & 314), complex variables (MATH 322), numerical analysis (MATH 316) and Matlab computing are advantageous, but not essential. Consult instructor for more specific information.

Future information at: *http://www.math.sfu.ca/~muraki*

Left two panels show stages of image reduction by rank-8 and rank-32 singular value decompositions of the full image on the right (http://www.cc.gatech.edu/ugrads/a/adjacent/).