Texas Tech University. Applied Mathematics Seminar.

LOCALIZATION PHENOMENA IN MATRIX FUNCTIONS: THEORY AND APPLICATIONS

Michele Benzi, Emory University

Friday, February 20, 2009

Room: MA 114, Time: 10:00am

ABSTRACT. Many physical phenomena are characterized by strong localization, that is, rapid decay outside of a small spatial or temporal region. Frequently, such localization can be expressed as decay in the entries of a function f(A) of an appropriate sparse or banded matrix A that encodes a description of the system under study. Important examples include the decay in the entries of the density matrix for non-metallic systems in quantum chemistry (a function of the Hamiltonian), the localization of the eigenvectors in the Anderson model, and the decay behavior of the inverse of a banded symmetric positive definite matrix. Localization phenomena are of fundamental importance both at the level of the physical theory and at the computational level, because they open up the possibility of approximating relevant matrix functions in O(N) time, where N is a measure of the size of the system. In this talk I will give an overview of theoretical results, algorithms, and applications in various parts of computational physics and numerical analysis.