APPLIED MATHEMATICS COLLOQUIUM

POTPOURRI ON STRUCTURED MATRICES

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ABSTRACT:

Many matrices encountered in applications have a special structure, e.g., Toeplitz, Hankel, Vandermonde, Cauchy, Pick, Bezoutians, and various others. Exploiting such structures allows one to design efficient algorithms, i.e., those outperforming standard algorithms in terms of the amount of computations, or accuracy, or amenability to parallel implementations.

(i) Different applied areas suggest different approaches to design such efficient algorithms; in this survey talk we shall highlight a technique based on a rational matrix interpolation interpretation. After giving a background material, a superfast algorithm for solving passive tangential interpolation problems of the Nevanlinna-Pick type will be described.

(ii) As a byproduct, a new algorithm for list decoding of the Reed-Solomon codes will be derived as an application of the above algorithm of part (i).

(iii) Finally, a new approach to solving the general eigenvalue problem via quasi-separable matrices will be addressed. We show how every symmetric matrix can be reduced to a quasi-separable matrix. We further propose a family of quasi-separable QR algorithms that include the classical tridiagonal QR algorithm as a special case. In the rest of the talk, we show that the characteristic polynomials associated with the leading blocks of a quasi-separable matrix satisfy three-term and two-term recurrence relations. Moreover, the class of all such polynomials includes the classical orthogonal polynomials (tridiagonal case) and the Szego polynomials (unitary Hessenberg case) as special cases.

MONDAY, NOVEMBER 14, 2005
4:30 PM
Building 2, Room 105

Reception at 4:00 PM in Building 4, Room 174.
(Math Majors Lounge)

Applied Math Colloquium: http://www-math.mit.edu/amc/fall05
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