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Contents

Key words. LMS-Newton adaptive filter algorithm, finite impulse response filter, Toeplitz matrix, circulant matrix, preconditioned conjugate gradient method, fast Fourier transform.

AMS(MOS) subject classification. 65F10.

Files.
vol.4.1996/pp14-36.dir/pp14-36.ps, vol.4.1996/pp14-36.dir/pp14-36.pdf.

Forward References.

37 A note on the accuracy of symmetric eigenreduction algorithms. *K. Veselić.*

Abstract. We present some experimental results illustrating the fact that on highly ill–conditioned Hermitian matrices the relative accuracy of computed small eigenvalues by QR eigenreduction may drastically depend on the initial permutation of the rows and columns. Mostly there was an "accurate" permutation, but there does not seem to be an easy method to get at it. For banded matrices, like those from structural mechanics, the accurate pre–permutation, if it existed, was mostly non–banded. This is particularly true of tridiagonal matrices which shows that the tridiagonalization is not the only factor responsible for the inaccuracy of the eigenvalues.

Key words. LAPACK, QR method, Jacobi method, Hermitian matrices, eigenvalue computation.

AMS(MOS) subject classification. 65F15.

Files.
vol.4.1996/pp37-45.dir/pp37-45.ps, vol.4.1996/pp37-45.dir/pp37-45.pdf.

Forward References.

46 Matrix continued fractions related to first-order linear recurrence systems. *P. Levrie and A. Bultheel.*

Abstract. We introduce a matrix continued fraction associated with the first-order linear recurrence system $Y_k = \theta_k Y_{k-1}$. A Pincherle type convergence theorem is proved. We show that the n-th order linear recurrence relation and previous generalizations of ordinary continued fractions form a special case. We give an application for the numerical computation of a non-dominant solution and discuss special cases where θ_k is constant for all k and the limiting case where $\lim_{k\to+\infty} \theta_k$ is constant. Finally the notion of adjoint fraction is introduced which generalizes the notion of the adjoint of a recurrence relation of order n.

Key words. recurrence systems, recurrence relations, matrix continued fractions, non-dominant solutions.

AMS(MOS) subject classification. 40A15, 65Q05.

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vol.4.1996/pp46-63.dir/pp46-63.ps, vol.4.1996/pp46-63.dir/pp46-63.pdf.

Forward References.

64 A note on Newbery's algorithm for discrete least-squares approximation by trigonometric polynomials. *Heike Faßbender.*

Abstract. Recently fast, efficient and reliable algorithms for discrete least-squares approximation of a real-valued function given at arbitrary distinct nodes in $[0, 2\pi)$ by

trigonometric polynomials were presented in different papers. These algorithms are based on schemes for the solution of inverse unitary eigenproblems and require only O(mn) arithmetic operations as compared to O(mn^2) operations needed for algorithms that ignore the structure of the problem. In 1970 Newbery already presented a O(mn) algorithm for solving the discrete least-squares approximation by trigonometric polynomials. In this paper the connection between the different algorithms is illustrated.

Key words. trigonometric approximation.

AMS(MOS) subject classification. 65D10, 42A10, 65F99.

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vol.4.1996/pp64-74.dir/pp64-74.ps, vol.4.1996/pp64-74.dir/pp64-74.ps.

Forward References.

75 A preconditioner for the mortar finite element method. *Mario A. Casarin and Olof B. Widlund.*

Abstract. Mortar elements form a family of nonconforming finite element methods that are more flexible than conforming finite elements and are known to be as accurate as their conforming counterparts. A fast iterative method is developed for linear, second order elliptic equations in the plane. Our algorithm is modeled on a hierarchical basis preconditioner previously analyzed and tested, for the conforming case, by Barry Smith and the second author. A complete analysis and results of numerical experiments are given for lower order mortar elements and geometrically conforming decompositions of the region into subregions.

Key words. domain decomposition, mortar finite element method, hierarchical preconditioner.

AMS(MOS) subject classification. 65F30, 65N22, 65N30, 65N55.

Files.
vol.4.1996/pp75-88.dir/pp75-88.ps, vol.4.1996/pp75-88.dir/pp75-88.pdf.

Forward References.

89 An analysis of the pole placement problem.
I. The single-input case. *Volker Mehrmann and Hongguo Xu.*

Abstract. For the solution of the single-input pole placement problem we derive explicit expressions for the feedback gain matrix as well as the eigenvector matrix of the closed-loop system. Based on these formulas we study the conditioning of the pole-placement problem in terms of perturbations in the data and show how the conditioning depends on the condition number of the closed loop eigenvector matrix, which is a similar to a generalized Cauchy matrix, the norm of the feedback vector and the distance to uncontrollability.

Key words. pole placement, condition number, perturbation theory, Jordan form, explicit formulas, Cauchy matrix, stabilization, feedback gain, distance to uncontrollability.

AMS(MOS) subject classification. 65F15, 65F35, 65G05, 93B05, 93B55.

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vol.11.2000/pp25-42.dir/pp25-42.ps,vol.11.2000/pp25-42.dir/pp25-42.pdf.

106 Ray sequences of Laurent-type rational functions. *I. E. Pritsker.*

Abstract. This paper is devoted to the study of the asymptotic zero distribution of Laurent-type approximants under certain extremality conditions analogous to the condition of Grothmann, which can be traced back to Walsh's theory of exact harmonic majorants. We also prove results on the convergence of ray sequences of Laurent-type approximants to a function analytic on the closure of a finitely connected Jordan domain and on the zero distribution of optimal ray sequences. Some applications to the convergence and zero distribution of the best L_p approximants are given. The arising theory is similar to Walsh's theory of maximally convergent polynomials to a function in a simply connected domain.

Key words. Laurent-type rational functions, zero distributions, convergence, optimal ray sequences, best L_p approximants.

AMS(MOS) subject classification. 30E10, 30C15, 41A20, 31A15.

Files. vol.4.1996/pp106-124.dir/pp106-124.ps.

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125 On the solution of Cauchy systems of equations. *D. Calvetti and L. Reichel.*

Abstract. The development of fast solution methods for linear systems of equations with a Cauchy matrix has recently received considerable attention. This note presents new solution methods based on a modification of an inversion formula described by Gastinel.

Key words. fast algorithm, linear system, Cauchy matrix, Hankel matrix, Toeplitz matrix.

AMS(MOS) subject classification. 65F10.

Files.
vol.4.1996/pp125-137.dir/pp125-137.ps, vol.4.1996/pp125-137.dir/pp125-137.pdf.

Forward References.

138 Local and global invariants of linear differential-algebraic equations and their relation. *Peter Kunkel and Volker Mehrmann.*

Abstract. We study local and global invariants of linear differential-algebraic equations with variable coefficients and their relation. In particular, we discuss the connection between different approaches to the analysis of such equations and the associated indices, which are the differentiation index and the strangeness index. This leads to a new proof of an existence and uniqueness theorem as well as to an adequate numerical algorithm for the solution of linear differential-algebraic equations.

Key words. differential-algebraic equations, invariants, differentiation index, strangeness index, normal form, existence and uniqueness.

AMS(MOS) subject classification. 34A09.

Files.
vol.4.1996/pp138-157.dir/pp138-157.ps, vol.4.1996/pp138-157.dir/pp138-157.pdf.

Forward References.

158 Remarks on the Ciarlet-Raviart mixed finite element. *Y.D. Yang and J.B. Gao.*

Abstract. This paper derives a new scheme for the mixed finite element method for the biharmonic equation in which the flow function is approximated by piecewise quadratic polynomial and vortex function by piecewise linear polynomials. Assuming that the partition, with triangles as elements, is quasi-uniform, then the proposed scheme can achieve the approximation order that is observed by the Ciarlet-Raviart mixed finite element when approximating the flow function and the vortex functions by piecewise quadratic polynomials.

Key words. Ciarlet-Raviart mixed finite element, biharmonic problem.

AMS(MOS) subject classification. 65L60.

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