Thursday, September 24

	Room A	Room B
8:15	**Frommer, A.:** Error Control in the Lanczos Process and Applications	
9:00	**Collavizza, H., F. Delobel, and M. Rueher:** Comparing Partial Consistencies	
9:45	Break	
	Linear Algebra IV	*Symbolic Computation and Fuzzy*
10:15	**Shary, S.P.:** Outer Estimation of Generalized Solution Sets to Interval Linear Systems	**Cuyt, A. and B. Verdonk:** A Multivariate Numeric-Symbolic QD-Algorithm
10:40	**Szulc, T. and B. Kołodziejczak:** Convex Sets of Full Rank Matrices	**Popova, E.D.:** Symbolic-Algebraic Interval Computation in *Mathematica*
11:05	**Watanabe, Y., N. Yamamoto, and M.T. Nakao:** A Verification Method of Generalized Eigenvalue Problems and its Applications	**Dimitrijević, S., B. Danković, D. Antić, and M. Stanković:** Data Representation Based on Fuzzy Logic Functions using Flexible Fuzzy Structures
11:30	**Kozina, G.:** Pareto Solutions of Linear Programming Problems with Interval Objective Function	**Dimitrijević, S. and D. Antić:** Computational Procedure for Non-minimum Phase Fuzzy Sliding Mode System
11:55	Lunch	
	Differential Equations II	*Foundations*
13:00	**Neher, M.:** A Taylor Series Based Enclosure Algorithm for ODEs	**Rohn, J.:** Solvability of Systems of Linear Equations and Inequalities with Inexact Data: Full Classification (A Survey)
13:25	**Petras, K.:** Validated Solution of ODEs via Runge-Kutta Methods	**Kallós, G.:** Hausdorff Dimension of Univoque Sets
13:50	**Rihm, R.:** Validated Predictor-Corrector Methods	**Lang, B.:** Subdivision Schemes for Multi-Dimensional Gaussian Quadrature
14:15		**Lakeyev, A.V.:** Computational Complexity of Estimation of Generalized Sets of Solutions for Interval Linear Systems
14:40	Break	
	Differential Equations and Control	*Accuracy in Function Evaluation I*
15:10	**Stanković, P., D. Antić, and M. Stanković:** Algorithm for Non-Minimum Phase Plant Controller Design Based on Chebyshev's Polynomials	**Alt, R.:** How to Check the Accuracy of the Solution of an Iterative Process
15:35	**Sokolova S.P. and R.S. Ivlev:** Constructing Control System of Uncertain Objects on the Base of the Common Parameter Method	**Dimitrova, N. and S. Markov:** Verified Computation of Fast Decreasing Polynomials
16:00	**Ermakov, O.B.:** Symbolic-Analytical Approach for the Construction of High-Exact Outer and Inner Estimations of the United Solution Set of Interval ODE System on the Basis of Taylor Series	**Lerch, M.:** Expression Concepts in Scientific Computing
16:25	**Rychkova, N. and V.S. Zyuzin:** An Approximation of a Solution of ODE System with Initial Conditions by Splines with Use of j-variables	**Heindl, G.:** A Representation of the Interval Hull of a Tolerance Polyhedron Describing Inclusions of Function Values and Slopes
18:00	Supper	

Friday, September 25

	Room A	Room B
8:15	**Corliss, G.F. and R.B. Kearfott:** Rigorous Global Search: Industrial Applications	
9:00	**Kearfott, R.B.:** Existence and Uniqueness Verification for Singular Zeros of Nonlinear Systems	
9:45	Break	
	Accuracy in Function Evaluation II	*Applications*
10:15	**Dyllong, E., W. Luther, and W. Otten:** An Accurate Distance-Calculation Algorithm for Convex Polyhedra	**Krastanov, M. and I. Moravski:** On the Efficient Portfolio Selection Problem
10:40	**Huber, E.H. and W. Barth:** Surface-to-surface intersection with complete and guaranteed results	**Kocsor, A., J. Dombi, and I. Bálint:** How to solve matrix-eigenvalue problems by optimizations of various functional inequalities?
11:05	**Sweidan, A. and A.A. Hiasat:** An RNS Error Correction Scheme based on Moduli With Common Factors	**Barve, J.J. and P.S.V. Nataraj:** A Robust QFT Controller Bound Generation Algorithm Using Interval Mathematics
11:30	**Kobkov, V.V.:** Interval Interpolation Hermite Spline-Functions	
11:55	Lunch	
	Optimization I	*Interval Arithmetic II*
13:00	**Casado, L.G., I. García, and T. Csendes:** A Heuristic Rejection Criterion in Interval Global Optimization	**Nesterov, V.:** Algebraic Properties of Twin Spaces
13:25	**Csallner, A.E. and M.Cs. Markót:** Termination Criteria and the Objective Function's Lipschitz Continuity by Interval Subdivision Methods	**Peregudov, D.A. and V.S. Zyuzin:** On Implementation of Interval Arithmetic and S. Markov's Arithmetic in the Form of j-complex Variable
13:50	**Csendes, T., L.G. Casado, and I. García:** Adaptive Multisection in Interval Global Optimization	**Men'shikov, G.G.:** Interval Arithmetic: Some Kinds of Subdistributivity
14:15	**Jansson, Ch.:** Convex-Concave Extensions and Applications	**Zyuzin, V.S.:** On a Way of Representation of the Interval Numbers
14:40	Break	
	Optimization II	*Enclosure II*
15:10	**Stoyan, Yu. and T. Romanova:** Optimization Problem of Placement of Interval Rectangles	**Kálovics, F.:** Relations between interval extensions and zone functions of a multivariate real function
15:35	**Pintér, J.D.:** Computation of Globally Optimized Point Arrangements on a Sphere	**Lebbah, Y. and O. Lhomme:** Extrapolation for interval methods
16:00	**Messine, F. and A. Mahfoudi:** Use of Affine Arithmetic in Interval Optimization Algorithms to solve Multidimensional Scaling Problems	**Ermakov, O.B.:** New Approach for the Construction of Twin Estimations of Fixed Point of the Volterra Integral Operator in the Interval Space
16:25		**Dobronets, B.:** Correction of interval solution of nonlinear system of equations
16:50	Closing Section	
18:00	Supper	
20:00	Folk Dance Show	

How to solve matrix-eigenvalue problems by optimizations of various functional inequalities?

András Kocsor and József Dombi[1]
Institute of Informatics, József Attila University, Szeged, Hungary, H-6220, Aradi vértanúk tere 1.
{kocsor, dombi}@inf.u-szeged.hu

Imre Bálint[2]
Institute of Theoretical Physics, József Attila University and Department of Pharmaceutical Analysis, Szent-Györgyi Albert Medical University, Szeged, Hungary, H-6720, Tisza L. krt. 80-82.
E-mail: ibalint@physx.u-szeged.hu

The determination of the eigenvectors and eigenvalues of large real and complex matrices is of considerable importance in various fields of science and technology. Generally the methods are devised either for determining all eigenvectors of the matrix simultaneously or only one-by-one succesively. These two types of algorithms are naturally related to small-scale and large-scale problems bearing a practical significance in relation to the size of necessary operating core memory. In spite of the ever-growing capabilities of the computers, an important class of problems in science and technology provides matrices the sizes of which are much beyond the possibilities of direct and simultaneous determination of all eigenvectors and eigenvalues. Furthermore also the nature of the problem often requires only a part of the eigenvectors and eigenvelues (generally the lowest ones).

The proposed novel algorithm belongs to the iterative class providing the eigenvectors one-by-one. The determination of the eigenpairs of real (and complex) matrices is ascribed to a local optimization problem yielding primarily the eigenvectors of the matrix. Non-negative, homogeneous functions have been established with coinciding local and global optima, which are located exactly at the eigenvectors of the underlying matrix. The homogeneous object functions are constructed from known metric inequalities, as the Cauchy-Schwartz-Bunyakovkij, Hölder, Milne or Minkowski inequality. Therefore the eigenvectors of the matrix can be found by well behaving optimization algorithms, as the minima of the associated 'eigenvector-function'. The optimization algorithm can be conducted to converge to the nearest eigenvector, which can be approached along a continuously decreasing curve emanating from the starting trialvector or to an eigenvector, which is associated with an eigenvalue in the vicinity of a preset parameter. This property of the algorithm is unique among the iterative methods, where the approach of an eigenvector is guided by the magnitude of the associated eigenvalue. Throughout the paper a family of eigenvector-functions are considered, which are all equivalent in the sense that the eigenvectors of the underlying matrix minimize them. However, not all of these functions are of the same practical utility. Some of them are devoted for establishing boundary conditions, while a special one is superior in convergence speed.

[1]Financial support of the Hungarian Science Fund (Grant No. OTKA T020150) is acknowledged.
[2]Financial support of the Hungarian Science Fund (Grant No. OTKA T4450) is acknowledged.