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Editorial

Real and Complex Dynamics of Iterative Methods

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Iterative methods play a significant role in the study of linear or nonlinear phenomena occurring in engineering, physics, economics, social sciences, life sciences, and medicine. In the recent years, the study of the dynamical behavior of the rational operator associated with an iterative method has become a rapidly growing area of research, since the dynamical properties of the rational operator give us important information about the convergence, efficiency, and reliability of the iterative method.

In this issue we have been focusing on the new trends in the edge between these areas of research: the analysis of iterative methods for solving nonlinear problems and the dynamical study of the associated fixed point operators. Although the main aims of the construction of iterative schemes are to get high order of convergence and computational efficiency, their stability is an important subject to be taken into account: the wideness of basins of attraction and the convergence to attracting elements different from the solution. The dynamical analysis of the iterative methods gives us interesting information about these topics.

This special issue was opened at the beginning of 2015 and closed in September of 2015. There were a total of 22 submissions and 7 of them were accepted for publication, after strict reviews, which gave important developments in iterative methods and their applications. The guest editors of this special issue hope that the presented results could outline new ideas for futures studies.

The purpose of this special issue was to stimulate the continuing efforts to combine numerical and dynamical tools for designing, developing, and applying iterative schemes for solving nonlinear problems, including also practical applications. The topics of the accepted papers cover the area from theory to real applications. In all of them, real and complex dynamical analysis have helped to the better understanding of some new and known iterative methods for solving nonlinear problems. We are pleased to present the selected manuscripts for this special issue.

In the manuscript "On Constructing Two-Point Optimal Fourth-Order Multiple-Root Finders with a Generic Error Corrector and Illustrating Their Dynamics," the authors have designed optimal (in the sense of Kung-Traub's conjecture) iterative schemes for solving nonlinear equations with multiple roots. The analysis of convergence is made in order to prove this optimal order and some tests are made, including basins of attraction, to check the agreement between theory and experiments.

On the other hand, Y. Ruojun et al. present a global coordinating method of large equipment scheduling in construction site. As large equipment moves slowly, a big quantity of energy is dissipated which must be minimized. To optimize transfer sequence, a table method can be adapted. In order to obtain the optimal solution, transfer table is divided into different areas resulting in an acceptable solution that develops into global coordinating solution of construction schedule.

In "Accounting for Recent Changes of Gain in Dealing with Ties in Iterative Methods for Circuit Partitioning," Y.-H. Kim and Y. Yoon have described an improved way of dealing with ties when modules are moved within a circuit partitioning algorithm based on an iterative procedure. The application of this technique improves the results obtained by LIFO procedure that is usually considered to be the best, by considering the most recent change in gain for each module.

J. Chen and C. Lin manuscript deals with the problems of static output feedback control and H_∞ controller design for discrete-time switched systems. By using a new linearization method and piecewise quadratic Lyapunov functions, the authors present new sufficient conditions for system stability and H_∞ controller design. Some numerical examples are used to check the effectiveness of the proposed method and, compared to the existing techniques, the proposed scheme is less conservative.

In "A Novel Iterative Method for Polar Decomposition and Matrix Sign Function," F. Soleymani et al. design a sixth-order iterative method for approximating the polar decomposition and the matrix sign function of an arbitrary complex matrix. This method is obtained from an iterative scheme constructed for nonlinear equations with global convergence on quadratic polynomials.

Y. Yang et al. analyze the credit risk of a business group by means of an iterative model. The analysis and simulations of this model essentially revealed the complexity of the credit risk of a business group and provided important theoretical insights for understanding the complexity of the credit risk of a business group, which can benefit further research in this area.

Finally, Y. I. Kim and Y. H. Geum use tools of complex dynamics in order to investigate the stability and convergence areas, the so-called basins of attraction, for a new optimal fourth-order multiple-root finder on quadratic polynomials raised to the power of m, which is the known multiplicity. A Möbius map is used to generalize these results and the qualitative behavior of the strange fixed points is analyzed. To complete this study, some comparisons are performed among different methods applied on several test functions.

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