Editorial

Recent trends on Computational and Mathematical Methods in Science and Engineering (CMMSE)

Computational Mathematics is in the edge of many branches of Science and Technology, as they develop as far it is involved. There exists a close relationship between the need of solving real problems arising from different areas as Physics, Chemistry, Engineering, Biomedicine or Economics, among others, and the mathematical modelization and approximation of the problems posed.

This is the importance of the existence of meetings in which this interdisciplinary exchange of information is possible, as it happens at International Conference of Computational and Mathematical Methods in Science and Engineering (CMMSE). This Conference has shown to be an effective melting pot of scientific knowledge from different branches of academic and industrial world.

We have the pleasure to present some selected manuscripts from those exposed at the Computational and Mathematical Methods in Science and Engineering (CMMSE) Conference. This Special Issue continues a fruitful line of CMMSE special issues (see [1–4]).

The algorithmic characterization of the nonsingular almost strictly sign regular matrices by means of Neville elimination is the aim of the first paper of this volume, by P. Alonso et al. [5].

T. Goessens et al., in [6], propose a new three scale approach for textile models: a one-dimensional fiber model, a meso-level in the middle and a fabric model. The authors present two upscaling techniques for the three step multiscale model, based on the application of the volume averaging method on a non-linear diffusion equation at the first level and an overlapping domain decomposition.

In [7], M. Grimmonprez et al. investigate the problem of nonlinear parabolic integro-differential equations with a known Neumann boundary condition on a part of the boundary and an unknown Dirichlet boundary condition on the other part of the boundary, as well as its approximation by means of a numerical time-discrete scheme.

The authors in Real dynamics for damped Newtons method applied to cubic polynomials [8], analyze the real dynamics of the damped Newtons methods applied to cubic polynomials, finding different behaviors to be avoided such as convergence to n-cycles or even chaos.

A block matrix analysis is proposed in Some results on determinants and inverses of nonsingular pentadiagonal matrices [9], to justify and modify a known algorithm for computing the determinant of a nonsingular pentadiagonal matrix having nonzero entries on its second subdiagonal, improving its accuracy and efficiency.

The design of analytical theories of planetary motion is addressed by J.A. López et al. in [10] by means of Poisson series developments depending on the selection of the anomaly to be used. In this work the authors develop an improved algorithm in order to use arbitrary anomalies included in the class of generalized Sundman anomalies as temporal variables.

The paper Error estimates for the full discretization of a nonlocal parabolic model for type-I superconductors [11], states an estimation of the solution of a vectorial nonlocal linear parabolic problem in terms of the magnetic field for superconductors of type-I. The convergence of the scheme and the corresponding error estimates are derived under appropriate assumptions.

The efficient estimation of the solutions of nonlinear systems of equations is the aim of the research presented by J.L. Hueso et al. in [12]. In this work the authors present a new family of iterative methods and its generalization, getting a new family with order of convergence six. Real dynamics is used to compare its performance with already known iterative schemes.

The authors in Low-complexity root-finding iteration functions with no derivatives of any order of convergence [13], propose a procedure to design Steffensen-type iterative methods, optimal in the sense of Kung–Traub’s conjecture. The main advantage of this procedure is that the schemes are transformed from iterative ones that use the derivatives, holding the order of convergence and the complexity introduced in the methods is minimum.

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In [14], E. Azhdari et al. analyze diffusion through a viscoelastic biodegradable material. By using the proposed mathematical model the behavior of a particular ocular drug eluting implant which describes drug delivery into the vitreous chamber of the eye is presented.

A two dimensional coupled model of drug delivery in the cardiovascular tissue using biodegradable drug eluting stents is developed by J.A. Ferreira et al. in [15]. The authors analyze its qualitative behavior and present simulations of the model, as well as a numerical implementations which show complete agreement with the expected physical behavior.

A general spline-based method is proposed in [16] by D. Barrera et al. in order to avoid the problem of the restriction in the number of grid points in the classical approach of the Differential Quadrature Method. A two-stage quasi-interpolant scheme is used to achieve the optimal approximation order.

R.H. De Staalen et al., in [17], present Error analysis in the reconstruction of a convolution kernel in a semilinear parabolic problem with integral overdetermination. In this work, an additional given global measurement ensures the existence of a unique weak solution and the unknown kernel function is approximated by a time-discrete numerical scheme based on Rothe’s method.

Market observations give clear evidence that financial quantities are correlated in a strongly nonlinear way. In [18], L. Teng et al. develop a strategy for pricing the Quanto option under dynamic correlation in a closed formula, including the calibration to market data.

In A classification algorithm based on geometric and statistical information [19], the authors address the long standing problem in computing of classification. The presented algorithm considers explicitly geometric and statistical characteristics of the data and combines them into a class representation.

The authors in [20] introduce a unified point of view that includes the most of one-point Newton-type iterative methods for solving nonlinear equations. A simple but novel idea allows them to design iterative methods with increasing order of convergence.

The aim of A 6(4) optimized embedded Runge–Kutta–Nyström pair for the numerical solution of periodic problems, by Z.A. Anastassi et al. [21], is to improve the non-FSAL embedded RKN 6(4) pair with six stages of M. EL-Mikkawy et al. The new method is derived after applying phase-fitting and amplification-fitting and has variable coefficients.

The authors in [22] study the asymptotic behavior of the solutions of the Poisson equation with Dirichlet conditions, showing the existence of a new deterministic term of zero order in the limit equation for the deterministic problem.

A significant input in Fixed Point Theory is presented by A.-F. Roldán-López-de-Hierro in [23], where the authors slightly modify the notion of simulation function by Khojasteh et al. and investigate the existence and uniqueness of coincidence points of two nonlinear operators using this kind of control functions.

In On inverses of infinite Hessenberg matrices [24], the authors extend a known result on the structure of finite Hessenberg matrices to infinite Hessenberg matrices and the results are applied to the inversion of infinite tridiagonal matrices via recurrence relations.

It is known that Klein/Sine–Gordon matrices are very important as they can accurately model many essential physical phenomena. The spectral method presented by F. Yin et al. in [25] can save memory and computation time from the hierarchical scale structure of Legendre wavelets.

In Determining P optimum calibration points to construct calibration estimators of the distribution function [26], the authors study the problem of determining the optimal values that give the best possible estimation under simple random sampling without replacement.

In some pathological cases in which the scalar Newton method does not provide a solution of a scalar equation f(x) = 0, H. Ramos in [27] proposes a successful strategy through solving an associated system of two equations.

D. Barrera et al. in [28] propose a different construction that avoids the main drawback of these boolean sum DQMs, that is, the number of evaluation points increases quickly with the degree of the B-spline. Also, explicit results for low degree B-splines are derived.


Moreover, M.L. Morgado et al. in [30] present an implicit scheme for the numerical approximation of the distributed order time-fractional diffusion equation with a nonlinear source term.

The paper by Z. Li et al. in [31] verifies the accuracy of an adaptive mesh refinement method numerically using 2-D steady incompressible lid-driven cavity flows and coarser meshes.

The authors in [32], present an algorithmic characterization of nonsingular almost strictly totally negative matrices.

In A Dynamical Communication System on a Network [33], deterministic and stochastic conflict resolution rules are considered.

Finally, the Editors are grateful to all the authors and referees for their excellent contributions to this special volume. Also, a special mention to Professor Wuytack is necessary, for his invaluable cooperation along all the process.

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