Methods and Applications of Analysis.
Vol. 26, No. 3, pp. iii–iv, September 2019

PREFACE

A conference entitled "The Sixth International Conference on Scientific Computing and Partial Differential Equations" with the purpose of celebrating Professor Roland Glowinski's 80th birthday was held during June 5-8, 2017, at Hong Kong Baptist University (HKBU) where Roland has been holding a University Distinguished Professorship since 2015. This conference was generously supported by Department of Mathematics of HKBU, and it was well attended by a number of world leading scientists in the areas of differential equations, optimal control, image processing, mathematical physics, and fluid mechanics. It was a very pleasant gathering of Roland's long-term collaborators, former students, and close friends, with fruitful scientific discussions and warming sharing of personal memory. To show our respect to Roland's significant contributions to a variety of areas such as scientific computing, fluid mechanics, solid and structure mechanics, optimization, control problems for distributed systems, we collect 12 excellent papers from the participants of the conference and publish them on this special issue in honor of Roland's 80^{th} birthday.

A Lyapunov function is exhibited in the paper "Exponential Stability of PI Control for Saint-Venant Equations with a Friction Term" by G. Bastin and J. M. Coron. It is allowed to study the exponential stability of nonuniform steady-states for Saint-Venant equations with a friction term under boundary feedback Proportional-Integral (PI) boundary control.

A. Caboussat addresses numerical solutions of the Dirichlet problem for an elliptic Pucci's equation in two dimensions of space by a least-squares approach in the paper "A Least-squares/relaxation Method for the Numerical Solution of a 2D Pucci's Equation". Numerical results show the convergence of the iterative sequence to the exact solution and the robustness of the proposed approach.

In the paper "Seismic Inversion and the Data Normalization for Optimal Transport", B. Engquist and Y. Yang summarize the full waveform inversion for seismic imaging and the application of optimal transport for computing the misfit between simulated and measured data. Advantages and disadvantages of different normalization techniques are discussed in detail. A new sign-sensitive normalization method is introduced and numerical examples are presented.

To describe time-dependent ligand-receptor interactions for applications in biosensing using field effect transistors, a partial differential equation is developed by R. M. Evans, A. Balijepalli and A. J. Kearsley in their paper "Diffusion-Limited Reactions in Nanoscale Electronics". A numerical approximation is constructed by applying the method of lines and verified by numerical results.

In the paper "Analysis of the Vanishing Moment Method and its Finite Element Approximations for Second-order Linear Elliptic PDEs in Non-divergence Form", X. Feng, T. Lewis and S. Schnake analyze the Vanishing Moment Method and a C^1 finite element method for the continuous and discrete approximations of $W^(2,p)$ strong solutions of second-order linear elliptic partial differential equations in non-divergence form. Numerical results are shown to verify the efficiency of the proposed method.

E. Gauci, A. Belme, A. Carabias, A. Loseille, F. Alauzet and A. Dervieux summarize some recent theoretical advances in their paper "A Priori Error-based Mesh Adaptation in CFD", together with some examples of applications of mesh adaptation in continuum mechanics.

In the paper "A Douglas-Rachford Method for Sparse Extreme Learning Machine", T. Kärkkäinen and R. Glowinski propose the Douglas-Rachford operator splitting method to solve a non-smooth and nonconvex optimization problem derived from a sparse predictive machine learning model. Some numerical experiments with real world data sets are presented to validate the efficiency of the proposed algorithm.

A novel weighted nonlocal total variation (WNTV) method is proposed by H. Li, Z. Shi and X. P. Wang in their paper "Weighted Nonlocal Total Variation in Image Processing". Numerical examples are reported to demonstrate that the WNTV method is efficient for many image processing and machine learning problems.

The alternating direction explicit method for time evolution equations with the time-dependent Dirichlet boundary condition and the zero Neumann boundary condition is derived and analyzed by H. Liu and S. Leung in their paper "An Alternating Direction Explicit Method for Time Evolution Equations with Applications to Fractional Differential Equations". Numerical examples are given to demonstrate the simplicity and the computational efficiency of the method.

In the paper "Curvature based Authentication of van Gogh Paintings", H. Liu and X. C. Tai introduce a novel curvature-based method to authenticate van Gogh paintings. They suggest using curvature images to capture the shape information in the paintings and a forward stage-wise feature selection method to select the appropriate features for art authentication. Numerical results show that the proposed method outperforms the state-of-the-art methods for art authentication.

A simple fluid-structure problem of a cavity filled with a Newtonian fluid with a lid made of a thick deformable structure is considered in the paper "Parameter Identification of a Fluid-Structure System by Deep-Learning with an Eulerian Formulation" by O. Pironneau. To recover the parameters of the structure (the lid) from the observation of its deformation, TensorFlow by Google is used and an Eulerian monolithic solver is introduced. Some numerical tests validate the proposed approach.

In the paper "On von Karman Modeling for Turbulent Flow near a Wall", J. Rappaz and J. Rochat present a mathematical analysis of von Karman's model and explain why this model is numerically ill-conditioned when using a finite element method and when the laminar viscosity is small.

Guest Editors:

Xiaoping Wang, *Hong Kong University of Science and Technology*;
Xiaoming Yuan, *The University of Hong Kong.*