Hindawi Publishing Corporation
Journal of Applied Mathematics
Volume 2014, Article ID 320831, 2 pages
http://dx.doi.org/10.1155/2014/320831

Editorial

Mathematical and Numerical Modeling of Flow and Transport 2013

Shuyu Sun,[1] Mohamed Fathy El-Amin,[2] and Bo Yu[3]

[1] *Computational Transport Phenomena Laboratory, King Abdullah University of Science and Technology, Thuwal 23955, Saudi Arabia*
[2] *Department of Mathematics, Aswan University, Aswan 81528, Egypt*
[3] *Department of Oil and Gas Storage and Transportation Engineering, China University of Petroleum-Beijing, Changping, Beijing 102249, China*

Correspondence should be addressed to Shuyu Sun; shuyu.sun@kaust.edu.sa

Received 5 May 2014; Accepted 5 May 2014; Published 10 August 2014

Application areas of flow and transport phenomena vary widely; however, accurate mathematical and numerical simulation of flow and transport remains a challenging topic from many aspects of physical modeling, numerical analysis, and scientific computation. This annual issue concerns numerical and mathematical analysis that are very important for all scientific, engineering, and environmental applications. Rapid progress has been seen in the analysis of flow and transport phenomena especially in recent years because of the significance of flow and transport to science and engineering. The list of papers published in this issue covers a wide range of applications using different approaches and analysis. The list of papers includes nanofluids transport, reservoir modeling, optimization problems, river flow, complex dynamic flow, traffic flow, and finally numerical scheme testing that may be stated as follows.

The first group of papers is devoted to investigate flow and transport of nanofluids. The paper entitled "*Similarity solution of Marangoni convection boundary layer flow over a flat surface in a nanofluid*" by N. Md. Arifin et al. introduced that the problem of steady Marangoni boundary layer flow and heat transfer over a flat plate in a nanofluid is studied using different types of nanoparticles. E. H. Aly and A. Ebaid presented two different analytical and numerical methods in the paper "*New analytical and numerical solutions for mixed convection boundary-layer nanofluid flow along an inclined plate embedded in a porous medium*" to solve the problem of mixed convection boundary-layer nanofluids flow along an inclined plate embedded in a porous medium. The paper "*MHD forced convection laminar boundary layer flow of alumina-water nanofluid over a moving permeable flat plate with convective surface boundary condition*" by S. M. AbdEl-Gaied and M. A. A. Hamad studied the problem of two-dimensional steady forced convection boundary layer viscous incompressible flow of alumina-water nanofluid over a moving permeable vertical flat plate under the effect of a magnetic field normal to the plate. P. Wang et al. have discretized the convective term by two different schemes, namely, strong and weak conservation schemes, in a paper entitled "*Study on the convective term discretized by strong conservation and weak conservation schemes for incompressible fluid flow and heat transfer.*" The paper "*Design and simulation of a fused silica space cell culture and observation cavity with microfluidic and temperature controlling*" by S. Fan et al. focuses on a principle prototype of space animal cell perfusion culture and observation.

The second group concerns oil reservoir problems. W. Wang et al. in the paper "*Flow patterns transition law of oil-water two-phase flow under a wide range of oil phase viscosity condition*" have introduced that a systematic work on the prediction of flow patterns transition of the oil-water two-phase flows is carried out under a wide range of oil phase viscosities, where four main flow regimes are considered including stratified, dispersed, core-annular, and intermittent flow. Also, a paper entitled "*Multiphase, multicomponent simulation for flow and transport during polymer flood under*

various wettability conditions" by J. H. Lee and K. S. Lee concerns accurate assessment of polymer flood which requires the understanding of flow and transport of fluids involved in the process under different wettability of reservoirs. Finally, the paper "*Pressure transient analysis of dual fractal reservoir*" by X.-H. Tan et al. discusses the semianalytical model of a dual fractal reservoir transient flow. In the paper "*Numerical simulation on flow field of oilfield three-phase separator,*" Y.-t. Liang et al. have studied the flow field of three-phase separator numerically with taking into consideration the production situation of PetroChina Huabei Oilfield.

Some fluid optimization problems are studied in the following group of papers. T. Tsukahara and Y. Kawaguchi presented a paper entitled "*Proposal of damping function for low-Reynolds-number k-ε model applicable in prediction of turbulent viscoelastic-fluid flow*" to study the problem of low-Reynolds-number k-ε model for viscoelastic fluid to predict the frictional-drag reduction and the turbulence modification in a wall-bounded turbulent flow. In another paper "*Link-based signalized arterial progression optimization with practical travel speed*" by W. Xianyu et al., the authors propose an algorithm on how to obtain an optimal coordinated signal timing plan with both optimal link bandwidth and optimal arterial bandwidth considering practical vehicles' speed. Q. Si et al. in the paper "*Multiobjective optimization of low-specific-speed multistage pumps by using matrix analysis and CFD method*" have studied multiobjective optimization problems in low-specific-speed pumps. In the paper "*Optimized weighted essentially nonoscillatory third-order schemes for hyperbolic conservation laws,*" A. R. Appadu and A. A. I. Peer have derived a third-order weighted essentially nonoscillatory (WENO) scheme by coupling a WENO spatial discretization scheme with a temporal integration scheme.

This group focuses on the river flow problems. In the paper "*The fractal dimension of river length based on the observed data,*" N. Zhihui et al. have used some variable dimension fractal analysis methods to study river flow discharge. M. Pannone et al. in another paper entitled "*A mathematical model for the flow resistance and the related hydrodynamic dispersion induced by river dunes*" have derived equation for the total flow resistance associated with river bedforms with focusing on the effect induced by the out-of-phase free surface undulations appearing in presence of sand dunes.

Complex flows problems are also presented in the following articles. T. Deng et al. in their paper "*Hydraulic transients induced by pigging operation in pipeline with a long slope*" have proposed a model for the dynamic simulation of the pigging process after water pressure testing in a long slope pipeline. The paper "*Dynamic characteristics of rotating stall in mixed flow pump*" by X. Li et al. is devoted to investigate prerotation generated at the upstream of the impeller, leakage flow at the tip clearance between the casing and the impeller, and strong reserve flow at the inlet of the diffuser. L. Ji et al. have studied the people-people interaction and the people-environment interaction in the occupants' evacuation process, in the paper "*Simulation of evacuation characteristics using a 2-dimensional cellular automata model for pedestrian dynamics.*" In the paper "*Mathematical analysis of Casson fluid model for blood rheology in stenosed narrow arteries,*" J. Venkatesan et al. have investigated the flow of blood through a narrow artery with bell-shaped stenosis.

Traffic flow problems are studied in two papers. W. Wu et al. in their paper "*Mixed platoon flow dispersion model based on speed-truncated Gaussian mixture distribution*" have presented a macroscopic mixed platoon flow dispersion model (MPFDM) based on field data, to simulate the platoon dispersion process along the road section between two adjacent intersections from the flow view. In the paper "*An efficient methodology for calibrating traffic flow models based on bisection analysis*" by E. C. Jia et al., results are presented for a pedestrian walkway for pedestrian flow up to 108 persons/min and the limitations of the implemented system are enumerated.

Finally some numerical issues are discussed in the following papers. Vorticity-stream function method and MAC algorithm are adopted to systemically compare the finite volume method (FVM) and finite difference method (FDM) in the paper "*Comparison study on the performances of finite volume method and finite difference method*" by R. Liu et al. The finite volume methods on nonstaggered grids are used to solve the viscoelastic-Newtonian two-phase model in the paper "*Simulation of stress distribution near weld line in the viscoelastic melt mold filling process*" by B. Yang et al.

In conclusion, this special issue presents and highlights new applications and new challenges in different five important research areas of flow and transport. This special issue is not intended to be an exhaustive collection nor a survey of all of the current trends in flow and transport research; many additional significant research areas of flow and transport still exist and remain to be explored, but multidisciplinary research effort remains a clear trend.

Acknowledgments

The authors would like to thank the participants of the special issue for their inspiring contributions and the anonymous reviewers for their diligent work, which led to the high quality of the special issue. The lead guest editor S. Sun would like to acknowledge KAUST Faculty Baseline Research Fund for supporting his research in flow and transport.

Shuyu Sun
Mohamed Fathy El-Amin
Bo Yu