Advances in Mechanical Engineering

Editorial

Advances in Mechanical Engineering
2016, Vol. 8(8) 1–2

DOI: 10.1177/1687814016663743
aime.sagepub.com
SAGE

Advanced approaches of modeling and measurement for turbulence and heat transfer

Turbulent flow and heat transfer are key issues in nature and numerous engineering applications such as human body, fluid machinery, machining facilities, and refrigeration systems. Insight into relevant transient and steady-state thermo-fluidic physics in such scenarios acts as constructive guidance for both engineers and scientists to improve the performance and reliability of facilities, analyze engineering failures, and understand complicated natural phenomena. Unfortunately, such complex fluid flow and heat transfer problems can rarely be solved analytically due to the strong nonlinearity of the Navier–Stokes equations and the complex nature of turbulence with heat transfer. Instead, advanced modeling and measurement techniques become compensatory yet powerful tools and have been widely used. Especially in recent years, a large number of advanced analytical, computational, and experimental techniques have been developed, which greatly contribute to the exploration of turbulence and heat transfer mechanisms.

The main objective of this Special Issue is to bring important information on advanced modeling and measurement techniques together. Their feasibility and performance in investigating various engineering problems are evaluated. In this Special Issue, five original research papers were accepted for publication based on critical peer review by qualified reviewers. We hope that such a frontier of turbulence and heat transfer could be continued to track the updated trend year by year.

An introductory review of the accepted papers is presented here. In the paper entitled "The impact research of control modes in steam turbine control system (digital electric hydraulic) to the low frequency oscillation of grid," theoretical models for frequency domain analysis were developed to investigate the effects of steam turbine control modes on low-frequency oscillation of grid. The effectiveness of such theoretical analysis was well validated by simulation using the control system's toolbox in MATLAB. In the paper entitled "Research on the aerodynamic characteristics of a lift drag hybrid vertical axis wind turbine," the effects of various parameters on unsteady aerodynamic and starting performances of a newly designed lift drag hybrid vertical axis wind turbine were numerically investigated. The performances of various turbulence models were evaluated based on experimental data. Fruitful guidance for engineering design was also obtained. In the paper entitled "Pressure fluctuation prediction in pump mode using large eddy simulation and unsteady Reynolds-averaged Navier–Stokes in a pump-turbine," both large eddy simulation and unsteady Reynolds-averaged Navier–Stokes equations in conjunction with a two-equation turbulence model were adopted to predict pressure fluctuation in pump mode of a pump-turbine. By comparisons between experimental and numerical results, the performances of these two different modeling methods were evaluated. In the paper entitled "Temperature field measurement of spindle ball bearing under radial force based on fiber Bragg grating sensors," fiber Bragg grating temperature sensors were proven to be an effective method in the measurement of temperature distribution in outer ring of a spindle ball bearing. Such a temperature field is physically beneficial for the reduction of spindle thermal error. Finally, in the paper entitled "Experimental investigation of flow boiling heat transfer and pressure drops characteristic of R1234ze(E), R600a, and a mixture of R1234ze(E)/R32 in a horizontal smooth tube," the effects of mass flux, heat flux, and quality of several refrigerants on flow boiling and pressure drop characteristics in a horizontal smooth tube was experimentally investigated. The corresponding experimental methods and findings from this study are useful for the design of evaporators.

Finally, we would like to thank all the contributors of this Special Issue for their support and cooperation. The evaluation of paper quality by qualified reviewers is greatly appreciated as well.

Gongnan Xie[1], Yong Hong Wu[2], Sergio Nardini[3], Benchawan Wiwatanapataphee[4], Nan Gui[5] and Yanlin Zhao[6]

[1]*Department of Mechanical and Power, Engineering, Northwestern Polytechnical University, Xi'an, China*
[2]*Department of Mathematics & Statistics, Curtin University of Technology, Bentley, WA, Australia*
[3]*Dipartimento di Ingegneria Industriale e dell'Informazione, Seconda Università degli Studi di Napoli, Napoli, Italy*
[4]*Department of Mathematics, Faculty of Science, Mahidol University, Bangkok, Thailand*
[5]*Collaborative Innovation Center of Advanced Nuclear Energy Technology, Key Laboratory of Advanced Reactor Engineering and Safety of Ministry of Education, Institute of Nuclear and New Energy Technology, Tsinghua University, Beijing, China*
[6]*School of Mechanical and Transportation Engineering, China University of Petroleum, Beijing, China*