Journal of Fluids Engineering

Guest Editorial

Special Issue on Flows in Rotating Machinery

Although nearly 5000 years have passed since the wheel was invented, and even if modern pumps and turbines have been mostly developed during the last two centuries, major challenges and innovation are still present in the area of rotating flows and rotating machinery. This is certainly related to the variety of applications where rotating fluids are now involved: rocket engine inducers, hydraulic or gas turbines, marine propellers, compressors, turbochargers, ventilators and blowers, marine or wind turbines, and pumps for various hydraulic systems are just some examples of industrial areas where new concepts, new designs, and optimization are needed.

One major new constraint, compared with the previous developments, is the requirement of compact silent machinery with improved efficiency, not only for design flow conditions, but also for off design or deteriorated operation, such as, in random order, partial flow rate, varying upstream flow rate, multiphase flow alimentation, aggressive fluids, instabilities, and specific hazards. Addressing these numerous issues requires skills in various scientific disciplines, such as Acoustics, Fluid Mechanics, Heat Transfers, Multiphase Flows, Combustion, Transport Phenomena, Rotor Dynamics, Fluid Structure Interactions, Flow Control, Materials…, and that list is probably not exhaustive. In many cases, technological improvements rely on a combination of expertise in several of these areas, while additional skills in electrotechnic and electronic do not hurt, especially to work on systems designed for energy recuperation or energy production. It should be also mentioned that the geometries of the machinery and the industrial systems where they operate are more and more complex, which makes the understanding and the optimization of the internal flows quite challenging. It requires cutting edge experimental techniques and specific modeling efforts for computational fluid dynamics, to address the current issues related to aerospace, nuclear, and naval applications, to cite only a few.

The International Symposium on Transport Phenomena and Dynamics of Rotating Machinery (ISROMAC) conference is one of the few well-established international meetings devoted to rotating flows and rotating machinery. It is organized every two years in Hawaii since 1985, and it has become for a large part of the scientific community a regular objective to present up to date research and achievements. Although the Pacific Center of Thermal-Fluids Engineering, which has created the conference and has been continuously involved in its organization, initially targeted the Pacific Basin as the primary audience, the conference now also attracts participants from many countries worldwide.

The 16th Symposium was organized in Waikiki with a new objective: enhance its background by specifically focusing on the various scientific and technical areas covered by the conference. The event has thus been divided into 30 forums, each of them devoted to a scientific issue. As improvements and new ideas require paying attention to cross-disciplinary works, it was intended to attract in each forum contributions that would not be systematically connected to rotating machinery. The final goal was to bring together faculty and research engineers working with various applications—and sometimes on fundamental issues only—to make the discussions more valuable. This first attempt has been partially successful, and there is no doubt that the next event in December 2017 will go further in that direction.

ISROMAC 16 has been attended by more than 300 researchers from 28 countries in America, Europe, Asia, and Oceania. A thorough review process of all full papers has been conducted, which has resulted in the selection of 19 papers to be published in this Special Issue of the ASME *Journal of Fluids Engineering*. It is a great pleasure for me to introduce these works, which are related to internal cooling (Paper 1), flow instabilities (2–5), rotordynamic forces (6,7), turbochargers (8), aeroacoustics (9,10), design and analysis of water and wind turbines (11,12), flow control (13), journal bearings (14,15), uncertainty quantification (16), hydrodynamics (17,18), and two-phase flows (19). I would like to thank the editor of the journal, Malcolm J. Andrews, for his initial acceptance of this idea, the Editorial Office, Amber Grady-Fuller, and the Production Team at the American Society of Mechanical Engineers for their assistance during the course of this Special Issue publication. I also would like to thank the authors of the papers for their efforts in preparing these contributions, and all the reviewers for their help to improve the papers and identify the most suitable contributions for this Special Issue.

Olivier Coutier-Delgosha
Chairman of the ISROMAC 16 Symposium,
Professor Arts et Metiers Paris Tech,
Associate Professor Virginia Tech,
Aerospace and Ocean Engineering,
Virginia Tech,
Blacksburg, VA 24061
e-mail: ocoutier@vt.edu

