Hindawi Publishing Corporation
International Journal of Rotating Machinery
Volume 2012, Article ID 142595, 2 pages
doi:10.1155/2012/142595

Editorial

Marine Propulsors and Current Turbines: State of the Art and Current Challenges

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Received 16 September 2012; Accepted 16 September 2012

Over the last decade, significant advances have been made in the design and analysis of marine propulsors and current turbines. This special issue compiles 14 original researches and review articles that describe the state-of-the-art and current challenges on the design, numerical, and experimental modeling of marine propulsors and turbines.

One of the primary challenges with the analysis and design of marine propulsors and turbines is accurate prediction of hydrodynamic cavitation, which can occur in different forms and can lead to noise, vibration, erosion, and thrust/torque breakdown. The predictive capability of different cavitation models is compared in A. Ducoin et al. for simulation of unsteady sheet/cloud cavitation on a hydrofoil, and in M. Morgut and E. Nobile for quasi-steady cavitation on two model-scale propellers. In J. W. Lindau et al., a CFD approach is presented for the performance prediction of an axial flow waterjet over a wide range of flow coefficients and operating inlet total pressure, and they explained the mechanisms that lead to cavity-induced thrust breakdown.

In addition to cavitation, another challenge with marine propulsors and turbines is the need to properly align the trailing wake for general 3D geometry, and consider the influence of spatially varying inflow, gap flow dynamics in application with ducts, and rigid body motion in waves. In Y. Tian and S. A. Kinnas, an improved wake alignment model is presented for the performance prediction of marine propellers at low-advance ratios using a 3D panel method. In J. Baltazar et al., a 3D panel method is presented for the performance prediction of ducted propellers, and they also focused on the importance of proper trailing wake alignment, particularly near the blade tip region. In M. Greve et al., a viscous-inviscid coupling method is presented to efficiently capture the viscous flow response of marine propellers in spatially varying wake. Finally, in S. A. Kinnas et al., efficient numerical models are presented for the analysis of the hydrodynamic response of marine propellers undergoing surge and heave motions.

In addition to normal operations, we have also invited papers to discuss the performance of marine propulsors in off-design and extreme operating conditions. In H. Jang et al., the influence of the upstream hull body and duct on the unsteady loads of marine propellers in crashback was simulated using Large Eddy Simulation (LES). In L. Savio and S. Steen, full-scale data collected over one and a half year and a fuzzy logic analysis method are presented for the identification of ventilation events on an offshore supply ship.

Finally, in addition to conventional marine propellers, we have also invited special papers to address the design, analysis, and testing of advanced concept propulsors and turbines. In S. Brizzolara et al., a modified Lerbs theory is presented for the design of Counter Rotating Propellers (CRT) for high-speed crafts. In M. Altosole et al., a simple and effective approach is introduced for the design of marine water jet propulsion systems. In D. Bertetta et al., experimental and numerical analysis of unconventional Contracted and Loaded Tip (CLT) propellers are presented. In M. R. Motley et al., the dynamic scaling of the transient hydroelastic response and failure mechanisms of self-adaptive composite marine propellers are discussed. Finally, in M. Takao and T. Setoguchi, the status of the art and current challenges of air turbines for wave energy conversion is summarized.

We hope that these papers will enrich our readers about the state-of-the art and current challenges related to the design and analysis of marine propulsors and turbines, and inspire new methodologies and design concepts.

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