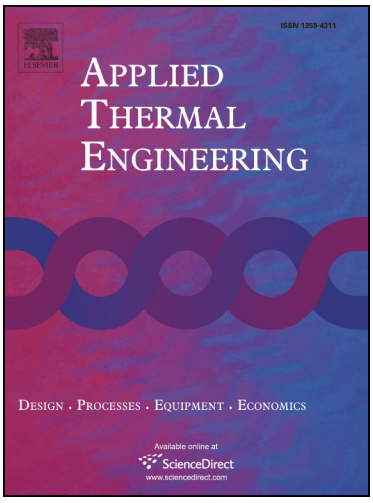

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CFD analysis of turbulent convective heat transfer in a hydro-generator rotor-stator system

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Abstract

This paper presents a numerical analysis of turbulent flow and heat transfer in the rotor-stator system of a hydro-generator scale model. The study is carried out through Computational Fluid Dynamics simulations using Reynolds-Averaged Navier-Stokes turbulence models based on the eddy-viscosity approximation. To reduce the computational cost, the steady state Multiple Frames of Reference mixing plane model is employed to handle the inherently unsteady flow in the rotor-stator system. Results point out that the mean flow, the turbulence field and the heat transfer in the rotor-stator air-gap are particularly sensitive to the turbulence model used. The comparison between the numerical results and the experimental data shows that the Shear Stress Transport $k-\omega$ model provides with reasonable accuracy the convective heat transfer values on the rotor pole face. Also in this work, the effects of thermal boundary conditions and fluid properties on the computed heat transfer coefficient are analysed in detail. It is found that the use of conjugate heat transfer method and temperature-dependent air properties improves the accuracy of the numerical predictions.

Keywords: hydro-generator, rotor-stator system, thermal analysis, conjugate heat transfer, Computational Fluid Dynamics.

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