THE NUMERICAL CALCULATION OF A PROTOTYPE KAPLAN TURBINE EFFICIENCY USING FULL 3-D NAVIER-STOKES SIMULATIONS

A. RAJA – MSC in Mechanical Eng.
School of Mechanical Engineering, IUST, CAEC, Tehran, Iran
Tel: 00982173916145
Amir.Raja@mecheng.iust.ac.ir

S. M. HOSSEINALIPOUR - *Associate Professor*.
School of Mechanical Engineering, IUST, Tehran, Iran
Tel-Fax: 00982177240191
Alipour@iust.ac.ir

K. MOBINI – *Assistant Professor*
School of Mechanical Engineering, Shahid Rajaee Teacher Training University (SRTTU), Tehran, Iran
kamobini@yahoo.com

S. HAJIKHANI – MSC in Mechanical Eng.
School of Mechanical Engineering, SRTTU, Tehran, Iran
Samaneh.hajikhani@gmail.com

ABSTRACT

A full three dimensional Navier – Stokes numerical simulation has been performed for performance analysis of a hydraulic Kaplan turbine. No simplifications have been enforced in the simulation. The numerical results have been evaluated using some integral parameters such as the turbine efficiency via comparing the results with existing experimental data from the prototype Hill chart. In part of this study the numerical simulations were performed in order to calculate the prototype turbine efficiencies in some specific points which comes from the scaling up of the model efficiency that are available in the model turbine Hill chart. The results are very promising which shows the good ability of the numerical techniques for resolving the flow characteristics in these kinds of complex geometries. A parametric study regarding the evaluation of turbine performance in four different runner angles of the prototype is also performed and the results are cited in this paper. The effect of runner blade angles on the static pressure distribution on the blades is also investigated numerically and the results are presented for a constant guide vane opening and four runner blade angles.

Key Words:

Power plant, Kaplan turbine, Runner, Computational Fluid Dynamics, Turbulent flow