Numerical analysis of the Coriolis effect on low-head hydraulic turbines

S. Ahn\textsuperscript{a}, Y. Xiao\textsuperscript{a}, X. Zhou\textsuperscript{a}, J. Zhang\textsuperscript{a}, C. Zeng\textsuperscript{a}, Y. Luo\textsuperscript{a}, W. Xu\textsuperscript{b} and Z. Wang\textsuperscript{a}

\textsuperscript{a}Tsinghua University, Haidian District, 100084 Beijing, China

\textsuperscript{b}National Research Institute for Rural Electrification, MWR OF CHINA, Hangzhou, 310012 Zhejiang, China

ansh13@mails.tsinghua.edu.cn

For the low-head hydropower station, the operating head is low, and the turbine intake channel is relatively short. The turbine internal flow behaviour can be influenced by fluid flows in the upstream reservoir easily, then it would influence the turbine hydraulic performance. Water flows in the upstream reservoir can be influenced by the Coriolis force by the Earth rotation, and it differs at the different Rossby number. In this paper, the Coriolis effect on the approach flows and the turbine performances are investigated numerically for the low-head units. Firstly, the Coriolis effect (under the different latitudes and the same characteristic length scale) on reservoir flows was predicted. Secondly, the prototype performance of a bulb-type turbine was simulated including the reservoir flow with the Coriolis effect, and then the effect on the turbine performance is be discussed. Results show that the flow field in the upstream reservoir at the low Rossby number, the ratio of inertial force to Coriolis force, can sufficiently influence the turbine intake flows and the turbine performances. Adjusting the side-wall distance can reduce the Coriolis effects

Number of words in abstract: 179
Keywords: Low-head turbine - Coriolis force effect - Upstream reservoir
Technical area: I. Hydraulic Turbines and Pumps