Proceedings of

16th International Seminar on Hydropower Plants, November 24 – 26, 2010, Vienna, Austria

Unsteady CFD Simulation of Kaplan Tip Clearance Vortex Flow

M. Koller, M. Sick

Abstract

Cavitation damage on Kaplan blades due to the pressure drop in the tip clearance vortex is a well known problem which often can be mitigated by installing anti-cavitation lips. From experiments the unsteady nature of the cavitating vortex flow is known to be related to the guide vane wakes. This article presents a CFD study of the time-dependent tip clearance vortex flow in a Kaplan model runner. A new, strongly refined time-dependent CFD simulation of guide vane and runner reveals that the guide vane wakes modulate the pressure field in the tip clearance vortex significantly.

Comparisons to observations at a model test show that the flow mechanism is correctly predicted. With this new CFD method both analyses of especially complex cases of blade tip cavitation and root cause analyses can be strongly supported.