

CFD Analysis on the Internal Flow Characteristics in the Draft Tube of a Francis Turbine

Qingsheng Wei¹ · Young-Do Choi⁺

Suppression of abnormal flow phenomena in the Francis hydro turbine is very important to improve the turbine performance. Especially, as cavitation and cavitation surge makes serious problems when the turbine is operated in the range of partial flow rate, optimum method of suppressing the abnormal flow characteristics is required necessarily. Moreover, as swirl flow in the draft tube of the Francis turbine decreases pressure at the inlet of the draft tube, suppression of the swirl flow can be a useful method of suppressing the occurrence of cavitation. In order to clarify the possibility of suppressing the swirl flow by J-Groove in the draft tube, a series of CFD analysis has been done in the ranges of partial load, designed condition and excessive flow rate of a Francis turbine. A kind of J-Groove is designed and applied to the draft tube of a Francis hydro turbine model. The pressure contours, circumferential velocity vectors and vortex core region in the draft tube are compared by the conditions with or without J-Groove. In addition, a group of data about the velocity in the draft is presented to show the influence of J-Groove.

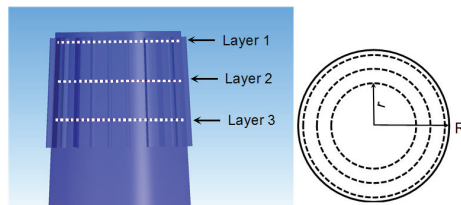


Fig. 1 Measurement layers and locations

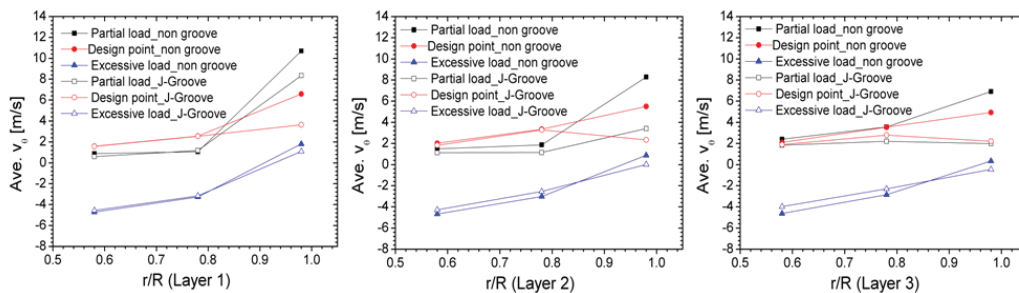


Fig. 2 Comparison averaged swirl velocity in draft tube of a Francis turbine with and without J-Groove

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References

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⁺ Young-Do Choi(Dep. of Mechanical Eng., Mokpo National University), E-mail: ydchoi@mokpo.ac.kr, Tel: 061)450-2419
1 Graduate School, Mokpo National University