

**COMPUTATIONAL INVESTIGATION OF FREE
SURFACE VORTEX FORMATION AT HORIZONTAL
POWER INTAKE OF SAMANALA HYDRO POWER
STATION**

Fernando N. T.

(148354 M)

Master of Science in Engineering

Department of Mechanical Engineering

University of Moratuwa

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Thesis submitted for partial fulfillment of the requirements for the Master of Science
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DECLARATION

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Dr. R. A. C. P. Ranasinghe

ABSTRACT

Analysis of free surface vortices formation in a horizontal type water intake structure of Samanala Power Station has in this study been carried out with the help of “Flow-3D” Computational Fluid Dynamic software. A numerical model was validated by using a physical model with horizontal protruded intake which is similar to the construction of Intake of the Samanala Power Station. The numerical model successfully captured the free surface vortex position during the validation process. The surface depression was not captured, however the tangential velocity distribution along the radial distance through the center line of the vortex, which was formed during the physical experiment, was in a good agreement with the tangential velocity distribution of Rankine Compound Vortex, where the middle of the vortex has a rotational flow field (forced vortex) and outside of the vortex it has an irrotational flow field (free vortex). After that, the model has been used to investigate the free surface vortex formation of the Samanala Intake. The intake was modeled by using “Solidworks” software. Due to unavailability of actual terrain data of the pond, I have considered the following: distance from the Dam, the depth of the pond and the intake side abutment angle, as the major parameters to be modeled during the pond modeling. Simulations were carried out to identify the formation of free surface vortices and their properties and characteristics by varying the submergence and fixing the flow rate to the maximum flow of the intake.

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