

## **Application of Reverse Engineering Method on Francis Turbine Runner Using 3D Scanning Techniques**

**Abstract**—The reverse Engineering Technique uses 3D scanning device that capture three-dimensional data into a digital format. The physical geometry is converted into computerized forms to carry out product development, design optimization and useful computational analysis. Within all reverse engineering techniques this method has proven to be more valuable to acquire 3D measurement of physical objects with higher accuracies, even for complex geometries. This paper presents reverse engineering approach for the remodeling of 3D Francis turbine runner. The scanned digital file of runner 23MW, which is one of the units of Marsyangdi Hydropower powerplant (69 MW) has been used as input in the modeling. The result from the 3D model developed using reverse engineering approach showed relatively close geometrical similarities. The deviation in the radii and blade thickness is 5.37mm, 2.4357mm, 3.5mm, 4.11mm and 2 mm respectively. The final model is validated by comparing the torque developed on rotating blades for the data input obtained from the power plant. The power obtained from the (Computational Fluid Dynamics) CFD analysis is 26.71MW. Using this technique, further analyses can be carried out for design optimization of the runner for maximizing efficiency, minimizing erosion and cavitation, as well as increasing the dynamic stability of the turbines.

**Keywords**—*Reverse Engineering, Modeling, CFD, Francis Runner, 3D scanning*