

Design and Performance Analysis of a Hydro-Power Rim-Driven Superconducting Synchronous Generator

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Abstract : The technology of superconductivity has developed in many power system devices such as transmission cable, transformer, current limiter, motor and generator. Superconducting wires can carry high density current without loss, which is the capability that is used to design the compact, lightweight and more efficient electrical machines. Superconducting motors have found applications in marine and air propulsion systems as well as superconducting generators are considered in low power hydraulic and wind generators. This paper presents a rim-driven superconducting synchronous generator for hydraulic power plant. The rim-driven concept improves the performance of hydro turbine. Furthermore, high magnetic field that is produced by superconducting windings allows replacing the rotor core. As a consequent, the volume and weight of the machine is decreased significantly. In this paper, a 1 MW coreless rim-driven superconducting synchronous generator is designed. Main performance characteristics of the proposed machine are then evaluated using finite elements method and compared to an ordinary similar size synchronous generator.

Keywords : coreless machine, electrical machine design, hydraulic generator, rim-driven machine, superconducting generator

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