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**STABILIZATION OF LABYRINTH SEAL FORCE BY INJECTING THE LEAKAGE
FLOW TO PRESWIRL GROOVE**

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ABSTRACT

Non-contacting seal is used to prevent leakage of turbomachineries, such as gas turbines and compressors. Since these turbomachineries tend to be operated under high pressure and high power, the fluid forces induced by the seal is one of the causes of instability. To reduce this instability, inlet swirl injection against rotation is sometimes applied in the preswirl groove. Recently, this practice was adopted at the seal between pump and turbine of LE-7A hydrogen pump and succeeded. In the calculation to evaluate the seal force, however, circumferential velocity of preswirl groove was assumed to be a half speed of injection velocity to the groove.

In this research, the distributions of circumferential velocity and pressure in the preswirl groove, that is, the inlet of the seal were calculated and the effect of the velocity and pressure distributions on the flow induced dynamic force was calculated. The results were compared with conventional type seals in order to know how much the instability force could be reduced. And also it was compared with the result calculated by assuming a half speed of the injection velocity. Finally, at the seal of LE-7A hydrogen pump the effect of these results on the stability of rotor was investigated by using a simple jeffcot rotor model.

Keywords: labyrinth seal, labyrinth seal instability, swirl injection, stabilization of seal,
turbo machine