THE INFLUENCE OF LABYRINTH SEAL DESIGN ON STEAM TURBINE ROTOR STABILITY: PARAMETRIC STUDY

Lubos Prchlik, Martin Wittner, Tomas Misek, Pavel Albl
SKODA POWER
Tylova 57, 31600 Plzen, Czech Republic,
E-Mail: LUBOS.PRCHLIK@SKODA.CZ

ABSTRACT

The following work has been motivated by a recent rotor stability problem encountered during the commissioning of a 94 MW steam turbine installed in a combined cycle. The excessive fluid induced whip-type vibration did not enable to operate the steam turbine above the 45% of its design power output. Design changes of labyrinth seals and bearings eliminated the vibration problem. The seal design changes were supported by the calculation of dynamic coefficients for turbine seals using "SEAL2D/3D" CFD code and the linear stability criteria prediction based on API 617/684 standards.
Following the successful application of the SEAL software, developed at the University of Mannheim, the dynamical coefficients of shroud seals used in the OEM steam turbines have been evaluated in this parametric study. Relevant parameters such as steam inlet pressure, pressure ratio, circumferential velocity, teeth pitch/clearance and labyrinth seal diameter have been varied. In the second part of the paper, the application of stability criteria based on API 617/684 is discussed for the turbine with instability.

Keywords: turbine shroud seal, fluid-induced vibration, damping, de Laval rotor