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Title

Stability analysis of simplified labyrinth seals model to geometric and flow hypotheses

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Abstract

The need for high turbopumps efficiency makes labyrinth seals a wide diffused subsystem in space engines. Indeed, by providing a winding path through a sequence of teeth and cavities, the role of this non-contacting component is to reduce the leakage of flow through the gap between stator and rotor parts from high-pressure to low-pressure zones, in turbines, and to limit recirculation phenomena between downstream and upstream zones in pumps. The high fluctuations of pressure and velocity deriving from their functioning, together with the necessity for light structures, lead labyrinth seals to be subject to aeroelastic instabilities, object of in-depth investigations in order to prevent failures caused by fatigue and provide safer turbopumps. This work presents the stability analysis of a straight-through two-fin labyrinth gas seal resulting from the variation of working conditions and parameters, in order to investigate how these ones can affect the system behavior in the case of an isentropic flow and strong fluid-structure coupling.