# STABILITY IMPROVEMENT OF A ROTOR SYSTEM BY MEANS OF FLEXIBLE SLEEVE FLUID FILM BEARING

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## ABSTRACT

This paper presents a newly developed flexible sleeve fluid film bearing for the vibration control of rotating machinery. Compared to a traditional fluid film bearing, the main feature of this bearing is the thin oil film beneath the flexible sleeve. The oil pressure beneath the flexible sleeve can be varied externally to achieve the desired dynamic performance in terms of the stability threshold of the rotor bearing system.

Linear and non-linear models have been developed for the rotor system which incorporates this new bearing. Modeling of the rotor and flexible sleeve is based on the finite element method and condensation techniques. The Reynolds equation is solved with the help of the finite difference method. The contribution of different design variables, such as the thickness oil chamber under the flexible sleeve, location of the external oil injection, thickness of the flexible sleeve etc. are investigated by means of the numerical simulations of the system motion. To extend the stability threshold of the rotor bearing system a genetic algorithm based optimization method has been introduced to optimize the design of this new bearing.

Experimental work is also presented to verify the theoretical prediction of the stability threshold. The experimental work shows, within acceptable tolerances, that the presented mathematical model can predict the performance of the rotor bearing system in terms of the orbit of the journal, critical speed of the rotor system and the stability threshold.

**Keywords**: stability, rotor, fluid film, bearing, optimization