Experimental verification of the deformable plate for studying squeeze film lifting effect

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Abstract:

Known squeeze film effect application described in scientific literature is the phenomena of Near Field Acoustic Levitation (NFAL). The implementation of the system is based on vibrating element and the lifted object placed above the inducer, which levitates due to squeeze film principle. Far-reaching goal is to construct a linear bearing meant to transport light objects in a non-contact conveyor and describe factors governing the phenomena. The conveyor surface will comprise multiple oscillating indentations. CFD, and in the next stage FSI, calculation of full complex system is highly time-consuming, therefore geometrically simplified axisymmetric model for one dimple was proposed. The purpose of the presented investigation is to provide verification of the CFD calculations. For this study an experimental plate was manufactured. The plate's membrane was exited to its first resonant frequency providing a single dimple. Excitation of the plate was achieved with the use of piezoelectric elements. The position of the lifted object (therefore the film thickness) was measured with the use of the displacement sensors. The results obtained on the test rig were compared with the CFD calculations. The influence of the amplitude of vibration, and the mass of the object on the height of the lifting will be presented in the paper

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