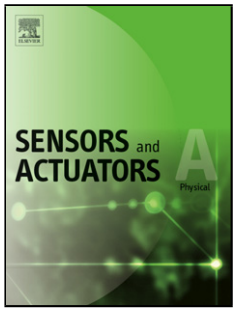

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Modelling of efficiency of synthetic jet actuators

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Abstract

A comprehensive and detailed modelling to evaluate the efficiency of energy conversion of piezo-electric actuators driving synthetic jets is developed. The contribution is original because the analysis is based on the energy equations of the two coupled oscillators, the membrane and the acoustic one, which are directly derived from the corresponding motion equations. The modelling is validated against numerical as well as experimental investigations carried out on home-made actuators having brass and aluminum shims on which the piezo-disk is bonded. A major result is that for aluminum shim the global efficiency (representing the conversion of input Joule power to kinetic power) decreases with increasing the applied voltage. Another finding is that the conversion process of mechanical power transferred, by means of the driving membrane, to Helmholtz oscillator kinetic power scales dramatically with the coupling degree of the oscillators. The coupling degree influences the efficiency of two cavities actuators sharing the same piezo-diaphragm as well. Considerations are reported to relate the theoretical orifice efficiency to the practical jet efficiency issuing in the external field.

Keywords:
efficiency, synthetic jet, piezo-electric