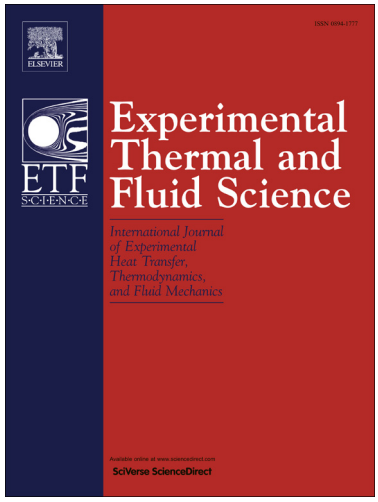

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Energetic efficiencies of synthetic and hybrid synthetic jet actuators driven by electrodynamic transducers

Jozef Kordík*, Zdeněk Trávníček, Miroslav Pavelka

Abstract

The paper investigates synthetic and hybrid synthetic jet actuators that are based on similar geometries. The actuators are supplied by a harmonic power input and are operated close to the first resonance frequency. An energetic efficiency is applied. The maximal outlet characteristic velocities and efficiencies of both actuators are studied as functions of the input real power. Theoretical approximations of these functions were derived for the synthetic jet actuator and successfully compared with experimental hot-wire results.

The paper demonstrates a usefulness of the applied definition of the energetic efficiency. Moreover, the advantages of the hybrid synthetic jet actuator were quantified. The hybrid synthetic jet actuator achieves a 15–23% increase in the velocities and a 41–48% increase in the energetic efficiency, both in comparison with the ordinary synthetic jet actuator working at the same input real power.

keywords: synthetic jet, hybrid synthetic jet, synthetic jet actuator, hybrid synthetic jet actuator, energetic efficiency, resonance

Nomenclature

B	damping	(kg/s)
Bl	force factor	(N/A)
e	voltage	(V)
E	fluid kinetic energy	(J)
E_{emf}	counter-electromotive force	(V)
f	actuating frequency	(Hz)
HSJ	hybrid synthetic jet	
$HSJA$	hybrid synthetic jet actuator	
i, I	electric current	(A)
K	spring constant	(N/m)
L	length	(m)
m	mass	(kg)
P_e	input real power	(W)
P	pressure	(Pa)
R	resistance of both speakers	(Ω)
Re	Reynolds number	(1)
S	cross-sectional area (with an	(m^2)
S	Stokes number	(1)

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