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Journal of Fluids and Structures 18 (2003) 663–664

JOURNAL OF FLUIDS AND STRUCTURES

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Preface

In recent years, there has been increased research interest in the area of flow–acoustic interactions, with the primary objective of better understanding the mechanisms of flow-induced noise and the effect of sound waves, whether self-induced or externally imposed, on these mechanisms. This renewed interest is not surprising given that flow–acoustic interaction mechanisms can generate deafening noise levels in the work place, annoying noise environment in neighbouring communities, or dangerous acoustic resonances that can cause acoustic fatigue of industrial equipments. This special issue includes 8 papers dealing with various mechanisms of sound generation by separated shear flows and the effect of flow–acoustic coupling on these mechanisms.

Flow over cavities is known to generate periodic oscillations of the unstable shear layer developing along the mouth of the cavity. When the cavity is housed in a pipeline or a conduit, it can excite powerful acoustic resonances of the pipeline. The interaction mechanism between a cavity shear layer and the acoustic modes of a pipeline is investigated by Geveci et al. in the opening paper of this issue. They employ high-density particle image velocimetry to shed more light on the formation of small-scale and large-scale vorticity concentrations and their role in the generation of sound power, which sustains the acoustic resonance.

The cavity-pipeline system is also the topic of the second paper by Lafon et al. In this case, however, the cavity oscillations excite higher (or transverse) acoustic modes of the pipeline. The authors use computation aeroacoustics and vibroacoustics to simulate and thereby better understand a vibration problem of steam piping in a power plant.

Control of cavity oscillations is the topic of the third paper in which Kuo and Jeng investigate the response of a cavity shear layer to rotational oscillation of a small cylinder placed near the cavity upstream corner. The authors focus on the ability to influence, or lock-on, the cavity oscillation by an active means using the cylinder rotational oscillation.

Vortex shedding in the wake of bluff bodies placed in a duct conveying flow is known to be capable of exciting the acoustic modes of the duct. This phenomenon is the topic of two papers in this special issue. In the first, Tan et al. simulate the flow–acoustic interaction mechanism for a long plate in a duct. They show that the main aeroacoustic sources which enhance the resonance are in the immediate vicinity of the plate trailing edge. In the second paper, Hall et al. investigate experimentally the effect of external sound waves on vortex shedding from two tandem cylinders in cross flow. The applied sound is found to entrain the process of vortex shedding over a much wider range of flow velocity than that observed for a single cylinder under similar conditions.

Matsumoto et al. experimentally investigate the Aeolian tones generated by flow over coiled wires such as those used as heating elements in gas flow. Interestingly, they report that the tones are generated by vortex shedding from the upstream portions of the coil, whereas the downstream portions do not contribute to these tones since their wakes are found to be rather turbulent.

The paper by Stoltenkamp et al. deals with an acoustic phenomenon which causes turbine flow meters to indicate spurious counts induced by acoustic oscillations. As a first step, they develop a model for the no-flow case to predict the threshold for the occurrence of spurious counts.

In the final paper, Matveev develops a theoretical model to explain experimentally observed nonlinear features of thermoacoustic oscillations. His model of a Rijke tube, which considers the nonlinearity of the heat transfer process, but uses linear acoustics, generates nonlinear oscillations, including higher harmonic components and the phenomenon of hysteresis.

I should mention that some of the papers in this Special Issue are expanded and up-dated versions of papers presented at the ASME International Symposium on Fluid–Structure Interaction, Aeroelasticity, and Flow-Induced Vibration and Noise (M. P. Paidoussis et al., Eds.), New Orleans, LA, USA, in November 2002.

I am indebted to many colleagues and friends who helped in producing this issue. First of all to the authors for submitting interesting and high quality papers, covering diverse topics on flow–sound interaction mechanisms. Many thanks to the reviewers who provided excellent and timely reviews, despite their help being called upon at short notice.

doi:10.1016/j.jfluidstructs.2003.08.015

I am particularly grateful to Emmanuel de Langre, Don Rockwell, Yong Tian Chew, and Dave Weaver for looking after the review process of several papers. Naturally, the final editing touches of the Principal Editor of the Journal, Michael Païdoussis, have made this Special Issue much better.

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