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Large-Eddy Simulations of Turbulence-Induced Vibration in Annular Flow

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This paper investigates the turbulence-induced vibration of a circular beam in annular pipe flow. Vibrations induced by turbulence are one of the causes of fatigue and fretting wear in process environments. Although the small-scale vibrations are normally not leading to immediate failure of structural components, they typically result in long term damage.

To predict the amplitude of these subcritical vibrations, current methods require an accurate description of the incident pressure field. However, measurements of cross-spectral pressure fields in annular geometries are rare. Models to describe the pressure field have a tendency to provide only descriptive information, after a series of experiments have been performed. Therefore this paper aims to predict the pressure field numerically, by means of wall-resolved large eddy simulations.

In order to validate this approach the flow field of an experiment available in literature [1] is computed. In the conditions simulated, water is flowing at 10 m/s in an annulus with a hydraulic diameter of 2.54mm. Pressure correlations obtained from the computations are compared to descriptive models such as the Corcos and Chase [2] models. The numerical power spectra are compared to the experimental spectra.

REFERENCES

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