Spanwise pressure coherence on prisms using wavelet transform and spectral proper orthogonal decomposition based tools

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Abstract: This paper presents new approaches to clarifying spanwise pressure coherence on typical prisms using some advanced tools based on continuous wavelet transform and spectral-branched proper orthogonal decomposition. Wavelet coherence and coherence modes have been developed for mapping characteristics of spanwise coherence of pressure and turbulence. Temporal-spectral spanwise coherence maps have been represented in the time-frequency plane and spatial-spectral spanwise coherence maps have been expressed in the space-frequency plane. Some new findings are that spanwise pressure coherence not only depends on spanwise separation, frequency and turbulent conditions, but is also influenced by bluff body flow and time. Intermittent and time-dependent pressure coherence in the time domain has been investigated as the nature of pressure coherence. Furthermore, distribution and intermittency of pressure coherence are significantly influenced by analyzed time-frequency resolutions and parameters of the analyzed wavelet function. The coherence mode has been proposed for better understanding of the effect of bluff body flow on pressure coherence. Physical measurements of surface fluctuating pressure and turbulence have been carried out on typical prisms with slenderness ratios of B/D=1 and 5 in turbulent flow.
Author Keywords: Coherence map; Coherence mode; Pressure coherence; Pressure field; Proper orthogonal decomposition; Wavelet coherence; Wavelet transform

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