

عنوان مقاله:

Continuous Wavelet Transform Analysis of Turbulent Wall Jet Evolving Through a Backward Facing Step

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خلاصه مقاله:

A continuous wavelet transform (CWT) is used to detect the most important scales governing the dynamics of a turbulent wall jet flow that evolves through a backward facing step. Our particular interest is the region downstream of the step. The fluctuating velocity signals obtained experimentally by a laser Doppler anemometer at different heights from the wall are first analyzed in Fourier space by performing the density energy spectra (PSD). In the recirculation zone, we noticed that the flow loses its equilibrium when we approach the wall. This is obviously due to the complex nature of flow dynamics which exhibits a complex structure with various scales. Then, we applied the CWT with two wavelet functions: the eighth derivative of a Gaussian which is selected on the basis of the wavelet entropy measures and a Morlet wavelet. The first one is used to locate the more energetic structures and the second to detect the dominant frequencies of the high energy structures. It turns out that, in the external zone characterized by the presence of intermittent eddies; most of the energy is concentrated in the large scale structures. In the shear layer, different scales of structures are observed. We can also observe the physical phenomena such as extension or breakup of structures. In addition, the relative wavelet energy is applied to give the energy distribution at each scale. On the other hand, the Morlet wavelet is used in order to monitor the dragging of large structures characterized by a low frequency (large scale) originating from the wall-jet's external region towards the reattachment region. It is shown that the energy of these eddy structures decreases along their dragging.

کلمات کلیدی:

Continuous wavelet transform, Morlet wavelet, The eighth derivative of a Gaussian wavelet, Turbulent flow, Wavelet entropy, Wall jet

