

Experimental Study of Turbulence Behaviour in a Warped Transition

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Abstract:

Transitions are needed to connect open-channel sections of different shapes and sizes that commonly exist in water supply channels, hydropower channels, irrigation canals, and so on. A warped transition (WT) smoothly connects a rectangular channel-section with a trapezoidal one and is considered the most efficient transition type with the least flow separation. This paper aims to experimentally investigate the turbulence characteristics in the WT. It reports acoustic Doppler velocimetry measurements of fluctuations in turbulence intensity, kinetic energy, and shear stress, as well as of the stationary flow field. The fluctuations are significant and entirely result from the influence of the transition. In the transition, the turbulence features a small jet-like core and reversed flows along one sidewall outside this core; even laterally averaged velocities have complicated vertical structures. This paper contributes to new benchmark turbulence conditions, useful for assessing the effectiveness of turbulence control devices and validating numerical models of turbulent flow.

Keywords:

warped transition, turbulence characteristics, ADV measurements, instantaneous velocity, separated flow, secondary flow.