Dispersive evolution of crossflow disturbances excited by an airjet column in a three-dimensional boundary layer

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An experimental study is made to show that dispersive properties of disturbances originating from a point source lead to the separate appearance of stationary vortices and travelling waves of the crossflow instability in a three-dimensional boundary layer. The spatial development of disturbances induced by a weak airjet issuing from a small surface hole near the attachment line of a yawed circular cylinder is observed at several downstream stations. Experimental results show that the disturbances evolve into a wedge-shaped distribution, which includes both stationary and nonstationary modes of the crossflow instability. The observed behavior of those disturbances is shown to be in fairly good agreement with recent results of a linear stability theory based on the method of complex characteristics, although there are some incongruities in frequency and growth rate of the most unstable disturbances. The experiment also shows the existence of a new instability due to the curvature of external streamlines, which was simultaneously predicted by the theory.

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