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Three-dimensional instabilities of vortices shed from a plunging wing: Experiments[1] ONUR SON, ZHIJIN WANG, ISMET GURSUL, University of Bath — The experiments are performed in a water tunnel to investigate the instabilities of vortices on a plunging wing. Parameters for periodic plunging motion are selected as k=0.25 to k=3 for reduced frequency, A/c=0.1 and A/c=0.5 for peak-to-peak amplitude ratio at a Reynolds number of 10,000. Vortical structures are revealed via three-dimensional velocimetry system. It is found that the instabilities on the leading-edge vortex are starting from the tip region. The leg of the leading-edge vortex remains attached to the wing surface until it sheds while instabilities are forming a helical shape similar to mode m=1. The wavelength of the instabilities on the leading-edge vortex are growing both in time and space. Both plunging frequency and plunging amplitude have an impact on instability wavelengths. Tip vortex has spiraling instabilities and the wavelength is found to be roughly constant for all cases in the measurement region. Trailing-edge vortex has similar instability characteristics with the tip vortex when they interact.

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