CZ.1.05/1.1.00/02.0060: Stability of a U-shaped profile in the wind 0-18 m/s

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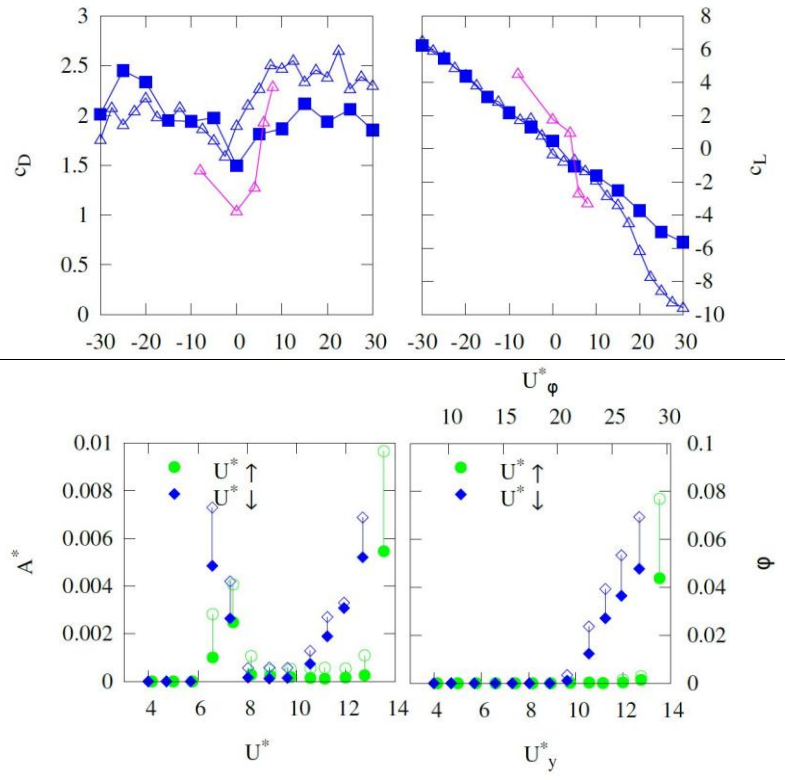
Motivated by assessing the aeroelastic stability of a conveyor solution, the aeroelastic stability of a U-beam with an aspect ratio (width *B* over frontal height *H*) of *B*/*H* = 4.62 is investigated. Wind-tunnel experiments involving a special test stand for sectional models and complementary CFD simulations were carried out. We find that the U-beam can perform self-excited two-degree of freedom (flutter) vibrations. This is also reflected in the simulation results. Vortex-induced vibrations were observed experimentally, but the amplitudes were small in respect to the frontal height. Numerically, it was found that there exist two different patterns of the flow around the U-profile: One pattern that is very similar to the flow around a rectangular prism ("R-flow" pattern) and another pattern were the flow "reaches" into the pocket of the profile ("U-flow" pattern). The amplitude of vortex induced vibrations depends strongly on the flow pattern. When the R-flow pattern is realized, the amplitudes were again small and of the same order of magnitude as in the experiments. When the U-flow pattern is realized, much greater vibration amplitudes were observed in the simulations. Up to now, this could not be observed in the wind tunnel experiments. However, for self-excited vibrations at higher reduced velocities it appears that the U-flow pattern cannot be sustained: After an initial phase the flow pattern changes to the R-flow pattern.



Vortex-induced vibrations: For increasing and decreasing reduced velocities different paths can be observed. The RMS-value of the mean-free displacement and angle (full symbols) and the respective maximum value (open symbol) are shown.