Abstract

When a cylinder is exposed to an uniform flow, vortices are shed alternately from the surface into the wake. Instabilities in the wake at relatively high Reynolds numbers are responsible for the formation of a Kármán vortex street which can induce acoustic pressure fluctuations on the cylinder surface as well as vortex induced vibrations (VIV). Both effects can be greatly increased by adding an interference body e.g. a plate or a square cylinder in the wake of the circular one.

Acoustic investigations of a rigid cylinder/plate-configuration have demonstrated the effectiveness of statistical experimental design. Different acoustic effects appear by changing specific geometric parameters of the plate (l_{plate}, d_{plate}, $h_{0,plate}$) as well as some flow parameters (c_{∞}, I_u). Aerodynamic investigations of a spring mounted circular cylinder show that a reduction of the fixed square cylinder distance leads to a higher oscillation amplitude of the upstream cylinder. Furthermore, there is an enlargement of the flow velocity region where *lock-in* takes place.

There are explicit differences between both amplification effects. The peak sound pressure level of a cylinder/plate-configuration is reached at higher distances ($g/d_{cyl} > 2$). Below that distance, the vortex separation process is suppressed. In addition, the magnitude of the sound pressure level can be increased by adding rather thin and long plates in the wake of the cylinder. In comparison, the increased oscillation due to VIV takes place at much lower distances between the interference bodies ($g/d_{cyl} < 1$). The length of the square cylinder does hardly influence the oscillation amplitude at all. These differences can be explained by regarding the origin of both amplification effects.