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Flutter instability of flags for different aspect ratios CHRISTOPHE ELOY, CLAIRE SOUILLIEZ, LIONEL SCHOUVEILER, IRPHE, Marseille, IRPHE, MARSEILLE, FRANCE TEAM — We address experimentally and theoretically the flutter instability of a flag in a wind. Clamped-free flags of various surface densities and flexural rigidities have been considered. Although this model problem of fluid-structure interaction has been studied continuously since the pioneering work of Lord Rayleigh in 1879, the existing theoretical models are unable to predict accurately the instability threshold. To take into account the finite aspect ratio of the flags, we have developed a linear model of 2D fluttering coupled to a 3D flow. The aspect ratio is defined as H/L, where H is the flag span and L its length (in the streamwise direction). In the Fourier space, an asymptotic theory is carried out to express the fluid load on the flag as powers of L/H. At first order, we recover the results of existing theories for infinitely extended flags. The second order is found to lower the average pressure on the flag, resulting in a stabilizing effect. The instability threshold is then a decreasing function of H/L in agreement with experimental results.

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