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Flow development over low aspect ratio cantilevered circular cylinders in the laminar shedding regime CHRIS MORTON, MOHAMMAD SAEEDI, ROBERT MARTINUZZI, University of Calgary — The flow development over a cantilevered circular cylinder of aspect ratio 4 at Re = 300 has been investigated numerically by employing a laminar flow solution to the Navier-Stokes equations. The results show that two distinct wake modulation frequencies are detectable downstream of the cylinder, differing from higher Reynolds number turbulent flow cases where only one dominant frequency is present. In particular, there is a low frequency modulation with a well-defined narrow-band peak (f_m), and a high frequency contribution from the shedding of vortices (f_v). The fluctuating loading on the cylinder in the streamwise direction is tightly coupled with the low frequency modulation, while the transverse direction forces show only a weak correlation with the vortex shedding frequency. Coherent flow structures have been analyzed using proper orthogonal decomposition (POD) to provide insight into the nature of vortex formation and associated coupling with the detected low frequency modulation. The temporal coefficients obtained from the POD analysis have been used to construct a low order model for the investigation of the overall flow development. While the high frequency component is known to be related to the formation and shedding of vortices, the low frequency component is shown to be associated with a modulation in upwash and downwash intensity.

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