Hydrodynamic mechanism behind the suppression of vortex-induced vibration with permeable meshes

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Vortex-induced vibration (VIV) induces resonant vibrations on elastic bluff bodies when exposed to a flow. A VIV suppressor called "ventilated trousers" (VT) - consisting of a flexible net with tens of bobbins fitted every other node - has been developed as a commercial solution. Only a few experiments in the literature have evaluated the effectiveness of the VT, but very little is know about the underlying mechanism behind the suppression. Experiments have been carried out in a water channel with models of circular cylinders fitted with three different permeable meshes. VIV response and drag were obtained for models free to oscillate in the cross-flow direction with low mass and damping (Re = 5 , 000 to 25,000). All meshes achieved an average 50% reduction of the peak amplitude and reduced the mean drag when compared to that of a bare cylinder. PIV visualization of the wake revealed that the VT produced a much longer vortex-formation length, thus explaining its enhanced efficiency in suppressing VIV and reducing drag. The geometry and distribution of the bobbins proved to be important parameters. PIV also revealed the rich three-dimensional flow structures created by the bobbins that disrupt the formation of a coherent vortex wake.

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