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Confined flow around a square prism

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ABSTRACT

A numerical investigation is conducted on the incompressible fluid flow around a square prism symmetrically placed in a rectangular channel. The effect of gap spacing ratio *g/d* (= 0.4 – 12.0) is studied on Strouhal number (*St*), time mean drag coefficients ($\bar{C}_D$), fluctuating lift coefficients (C'_L) and flow structures where *g* is the spacing between the prism and channel wall and *d* is the height of the prism. For all simulations, Reynolds number (*Re*) is fixed at 100. It is observed that the *St* and $\bar{C}_D$ both increase with decreasing *g/d.* On the other hand, with increasing *g/d*, the C'_L decreases for 0.4 <*g/d* < 1.0, increases for 1.0 ≤ *g/d* < 2.0 and again decreases for 2.0 < *g/d* ≤ 12.0. Three distinct vortex shedding regimes are observed (a) wall-dominated vortex street (0.4 ≤ *g/d* < 1.0), (b) reverse Karman vortex street (1.0 ≤ *g/d* < 3.5), and (c) Karman vortex street (3.5 ≤ *g/d* ≤ 12).

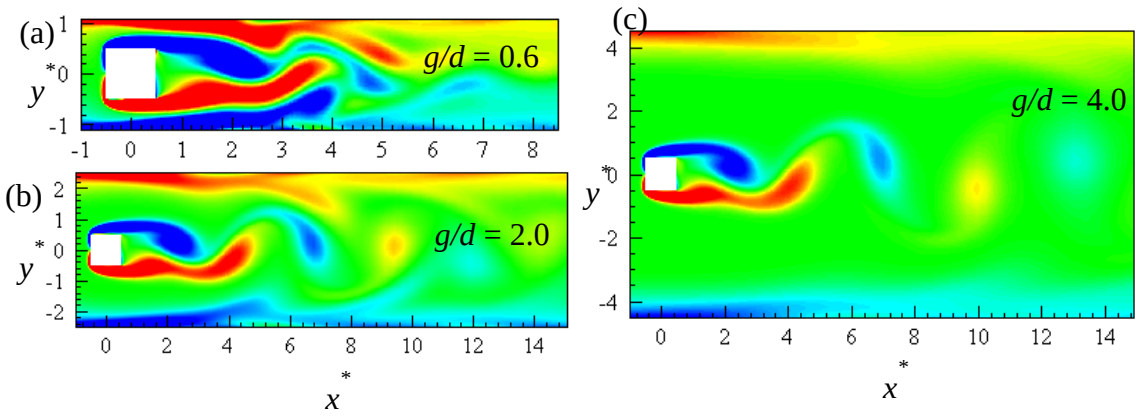

Fig. 1 Vorticity contours around a square prism (a) wall-dominated vortex street, (b) reverse Karman vortex street and (c) Karman vortex street.

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