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Oscillation, bifurcation and growth of modal instability in bluff-body wakes: a new understanding[1] AMALENDU SAU, Gyeongsang National University — Past experimental findings suggest during nucleation of a vortex over a bluff body the near-wake instability initiates a wavy trail even at Re=30, and wavelength of this oscillation decreases with increasing Re while amplitude increases. We discovered that, such a wavy oscillation has a strong spanwise counterpart which gets fast augmented with Re, and enforces growth of a new class of bifurcations along the Kármán vortex cores. Notably, the detected pressure oscillation along a vortex core reaches a threshold value at the onset of shedding process and initiates growth of a Hopf bifurcation in spanwise coordinate. With Re the pressure oscillation gains momentum; enforcing occurrence of multiple local pressure maxima and bifurcations along a vortex coreline. Our detailed simulations with square cylinders of different aspect ratios and Re up to 240 unfold development of two physically distinct stages of spanwise wake undulations and bifurcations. While growth of uniform length-scaled bifurcations and their spatio-temporal swapping initiate formation of "Mode A" instability structures, a transition scenario for the "Mode B" is prompted with the eruption of variable length-scaled spanwise bifurcations.

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