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Comment on "Criterion for Vortex Periodicity in Cylinder Wakes"

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IN reviewing many papers, Ericsson and Reding[1] have concluded in their Note that a necessary condition for the establishment of vortex periodicity in cylinder wakes is the existence of a well-defined, two-dimensional separated flow region. They have suggested also that the periodic vortex shedding with the associated problems of self-excited oscillations could be eliminated by introducing three-dimensional flow disturbances that prevent the formation of a well-defined, two-dimensional flow separation geometry.

Ericsson and Reding[1] have omitted an important paper by Naumann et al.,[2] where the same conclusions are drawn based on experimental results. Naumann et al. have experimentally studied the effect of artificially forcing separation of the flow on cylinders by means of separation wires and observed that the periodic vortex shedding could be avoided by means of zigzag separation wires along the cylinder span. Based on experimental results, they have also given a criterion for the minimum amount of three-dimensional disturbance necessary to avoid periodic shedding of vortices.

Through acoustic measurements, Keshavan[3] has also shown that by forcing nonlinear spanwise separation of the flow on circular cylinders, one can avoid periodic vortex shedding and the associated noise. The nonlinear separation of the flow along the span of the cylinder was achieved by blowing through three tangential slots. The three tangential spanwise slots used were of different lengths along the span and located at different azimuthal angles. This arrangement of slots produced an irregular separation line resulting in tl strong attenuation of periodic vortex shedding noise.

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Reply by Authors to N. R. Keshavan

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IN his Comment to our Technical Note,[1] Keshavan quite correctly points out that the work by Naumann et al.,[2] which we for some reason did not uncover in our literature search,[3] has important implications in regard to our conclusions. The detailed experimental research by Naumann et al.[2] shows conclusively that a well defined two-dimensional flow separation is needed for the establishment of a Karman vortex street. The main point of our Note is that the absence of vortex periodicity in the critical Reynolds number region is due to a lack of a two-dimensionality, caused by the spanwise variation of the boundary layer transition. How this leads to an absence of self-excited oscillations is discussed in more detail in Ref. 4.

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