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On the intermittent route to resonance for flow through an orifice in a duct MANU KAMIN[1], JOSEPH MATHEW[2], Indian Inst of Science — In experiments done by Vineeth et. al. (2015) on flow in a duct-orifice arrangement, flow enters through the duct inlet, and leaves into the atmosphere through the orifice exit, whistling was observed at a Reynolds number of 4200, where large amplitude pressure oscillations were observed. At slightly lower Reynolds numbers, bursts of smaller amplitudes of pressure oscillations were observed to appear intermittently. For a similar configuration, LES were carried out. Both whistling and intermittency were observed in the simulations. As air flows from the duct into the orifice, it turns sharply around the corner at the duct-orifice interface, and hence, flow separation occurs, and a shear layer is formed at the mouth of the orifice. The mechanism of whistling was found to be the shear layer within the orifice flapping about and hitting the trailing edge of the orifice periodically, thus causing the shear layer to break and roll up into a vortex. Hurst exponent was measured in the time series data obtained. It was found to gradually drop to zero as the flow approached the state of whistling, since the growth rates of all the long term and short term trends in the time series vanish. A loss of multifractality in the time series was also observed as flow approached whistling.

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