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Direct Numerical Simulation of Forced Round Jets MURALIDHAR KRISHNAMURTHY, Professor, Department of Mechanical Engineering, Indian Institute of Technology Kanpur 208016, TRUSHAR GOHIL, Doctoral student, ARUN SAHA, Assistant Professor — Jet control leading to noise reduction and efficient combustion can be achieved by manipulating its coherent structures. In the present study, direct numerical simulation of free circular (round) jets has been performed for two types of forcing, namely, flapping (FLP) and dual-mode excitation (DME). A Reynolds number of 1000 based on average jet velocity and nozzle diameter is considered. A small scale perturbation of 5% rms velocity is initially added to the three velocity components. DME perturbation is obtained by combining an axisymmetric excitation at the preferred mode frequency and helical excitation at a frequency fixed by the disturbance frequency ratio. For both contexts, the amplitude of the large scale excitation is 15% of the base velocity. The finite difference representations are second order accurate in time, fourth order in the advection term and sixth order in diffusion. With small-scale perturbation, well-defined vortex rings are shed at the preferred mode frequency. With DME, a spectacular increase of jet spreading is seen on one of the orthogonal planes. On the other hand, for the FLP perturbation, the circular jet shows a bifurcation pattern that is practically a Ψ-shape.

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