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The influence of the density ratio on the linear frequency response of low-density jets[1] WILFRIED COENEN, ALEJANDRO SEVILLA, Área de Mecánica de Fluidos, Dpto. de Ingeniería Térmica y de Fluidos, Universidad Carlos III de Madrid, Spain, LUTZ LESSHAFFT, Laboratoire d'Hydrodynamique (LadHyX), École Polytechnique - CNRS, France — Low-density jets support global self-sustained oscillations when the jet-to-ambient density ratio is sufficiently small, a phenomenon that has been linked to the presence of a region of local absolute instability in the underlying parallel base flow. However, the use of local stability analysis requires introducing ad-hoc criteria to match the experimental observations (see Coenen & Sevilla, J. Fluid Mech. 713, 2012, and references therein). In this work we therefore use a global approach, where the wavepacket structures are temporal eigenmodes of the linearized equations of motion in a 2D domain. The resulting eigenvalue spectra show that, when the density ratio is decreased, a discrete eigenmode becomes increasingly dominant, eventually reaching a positive growth rate for a certain critical density ratio. For the particular case of a He/air jet, this critical density ratio, as well as the corresponding oscillation frequency, is in good quantitative agreement with the experiments of Hallberg & Strykowski (J. Fluid Mech. 569, 2006). The influence of the density ratio on the linear frequency response of the jet under globally stable conditions is also investigated.

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