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Local stability of axisymmetric plumes[1] CHAKRAVARTHY R.V.K., LUTZ LESSHAFFT, PATRICK HUERRE, Ladhyx, CNRS, Ecole polytechnique, 91128 Palaiseau Cedex, France — A linear stability analysis of a forced plume with non-zero momentum at the inlet is performed for $Pr = 1$, $Re = 100$ and Ri near 1. The steady base flow is obtained as a laminar solution of the steady Navier Stokes equations. The base flow asymptotes to a self-similar solution as it evolves downstream. In the non-self-similar regime close to the inlet, both axisymmetric mode ($m = 0$) and the helical mode ($m = 1$) are convectively unstable at sufficiently low Richardson number. In the self-similar regime, only the helical mode is absolutely unstable and the axisymmetric mode is stable. Higher helical modes ($m \geq 2$) are seen to be convectively unstable very close to the inlet and become stable as the flow evolves downstream. The transition from convective to absolute instability makes the flow a good candidate for observing steep nonlinear global modes associated with buoyancy.

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