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On the existence of an overlap region between the Greens function for a locally parallel axi-symmetric jet and the leading order non-parallel flow solution[1] VASILIS SASSANIS, Mississippi State University, MOHAMMED AFSAR, University of Strathclyde, ADRIAN SESCU, Mississippi State University, SANJIVA LELE, Stanford University — We consider determination of the propagator within the generalized acoustic analogy for prediction of supersonic jet noise. The propagator is a tensor functional of the adjoint vector Greens function that requires solution of the linearized Euler equations for a given mean flow. The exact form of these equations can be obtained for a spreading jet. However since high Reynolds number jets have small spread rates, $\epsilon << O(1)$, this parameter can be exploited to formulate an asymptotic model that encompasses mean flow spatial evolution at leading order. Such a model was used by Afsar et al. (AIAA-2017-3030 for prediction of supersonic jet noise. We show the existence of an overlap between this solution (valid at low frequencies) and one based on a locally parallel (i.e. non-spreading) mean flow, valid at $O(1)$ frequencies. It is clear that there must exist an overlap between these solutions, since the former non-parallel solution was determined at the distinguished limit where the scaled frequency $\Omega = \omega/\epsilon = O(1)$ was held fixed. Hence the inner equation shows that as $\Omega \to \infty$, non-parallelism will be confined to a thin streamwise region of size $O(\Omega^{-1})$ and will, therefore, be subdominant at leading order when $\Omega Y = \bar{Y} = O(1)$.

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