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An investigation of non-parallel flow effects on the linear stability of turbulent reacting swirling jets[1] CHRISTOPHER DOUGLAS, TRAVIS SMITH, BENJAMIN EMERSON, TIMOTHY LIEUWEN, Georgia Institute of Technology — This work considers the linear hydrodynamic stability framework for reacting swirling jets in a premixed swirl combustor. In typical local stability analyses of such flows, a significant amount of the base flow field information is neglected by the parallel flow assumption, despite the often highly non-parallel nature of such flows. Implementation of a global stability analysis addresses this issue. However, global stability analysis requires suitable streamwise boundary conditions which are often non-trivial and/or physically dubious. Additionally, global stability methods are significantly more costly than weakly-global techniques which are based on solutions to a sequence of locally-parallel problems and linked using WKBJ theory. This motivates an effort to identify the pitfalls of locally-parallel methods and establish techniques for improved hydrodynamic modeling of spreading swirling jets without requiring the imposition of streamwise boundary conditions. Therefore, we analyze experimental combustor data to demonstrate the effects of non-parallelism that a locally-parallel analysis would neglect, and we propose a modified framework to address this issue.

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