Abstract Submitted
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Combustion LES and the stochastic fields method WILLIAM JONES[1], Imperial College London — Honoring Ted OBrien. The large eddy pdf equation formulated by Gao and O'Brien is a powerful method for simulating turbulent combustion. No assumptions are required regarding specific modes of burning so the method is applicable to non-premixed and partially and perfectly premixed flames including ignition and extinction. The large eddy pdf equation involves a large number of independent variables so that stochastic methods are required for its solution; in the present work the stochastic fields method is utilised. It has been applied to simulate the evolution of self-excited thermo-acoustic instabilities in a gas turbine model combustor, using a fully compressible formulation. An unstable operating condition in the PRECCINSTA combustor, involving flame oscillation driven by thermo-acoustic instabilities, is the chosen target configuration. The flame's self-excited oscillatory behaviour is successfully captured without any external forcing being involved. Power spectral density analysis of the oscillation reveals a dominant thermo-acoustic mode at a frequency of 300 Hz providing remarkably good agreement with experimental observations. Moreover, the predicted limit-cycle amplitude closely matches the experimental value obtained with rigid metal combustor side walls.

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