Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

LES-inspired forcing technique for DNS of turbulent premixed flames CHANDRU DHANDAPANI, Graduate Aerospace Laboratories, California Institute of Technology, GUILLAUME BLANQUART, Mechanical Engineering Department, California Institute of Technology — Direct numerical simulations (DNS) of high Karlovitz number (Ka) flames have been performed extensively in an inflow/outflow configuration, but in the absence of mean shear. Without a mean shear to sustain turbulence, the turbulent kinetic energy decays in the domain. Hence, a turbulence forcing has been used in previous simulations to emulate the missing shear effects. Rather than using an arbitrary forcing, the current study uses a source term for this turbulence forcing obtained from the results of previously performed large eddy simulations (LES) of a practical turbulent jet flame. The pseudo-shear term used for this turbulence forcing is linear and takes the form $A_{ij}u_j$ in the momentum equation, such that the source term is proportional to the velocity fluctuations. Different forms of the proportionality matrix A_{ij} are considered, including a scalar matrix $A\delta_{ij}$. DNS of high Ka n-heptane air flames are performed with the new forcing and the energy spectrum is calculated. This energy spectrum is combined with that obtained from the LES and compared with results from previously performed experiments of turbulent jet flames.

Chandru Dhandapani
Graduate Aerospace Laboratories, California Institute of Technology

Date submitted: 01 Aug 2016 Electronic form version 1.4