Readme file for "Analysis of the combined modelling of sub-grid transport and filtered flame propagation for premixed turbulent combustion"

The methodology adopted to generate the data is discussed in details in Section 2 & 5 of the paper (i.e. DNS Database & Postprocessing Methodology). Please refer to those sections of the paper and references therein.

The results corresponding to Figure 1 are kept in a sub-folder called 'Fig1'

- Description of 'Fig1': It has a gnuplot script for generating Fig. 1 of the paper together with the raw data called in the gnuplot script.
- Fig. 1 description: Magnitude of the SGSF model expression $\nabla \cdot (\overline{\rho \boldsymbol{u} c} - \bar{\rho}\tilde{\boldsymbol{u}}\tilde{c}) \times \delta_{th}/\rho_0 s_L$ for the GH model T^{GH} compared with its DNS counterpart T^{DNS} for flame D and a filter width of $\Delta/\delta_{th} = 0.8$. The relative error is given by $\varepsilon = \int_0^1 |T^{DNS} - T^{GH}|\, d\tilde{c} \,/\, \int_0^1 |T^{DNS}|\, d\tilde{c}$ (see Eq. 14). Both integrands are shown as well in the figure.
- Naming convention of the files in 'Figure 1': epsilon.gnu is the gnuplot script which reads the data contained in Gemischt_gnuplot.dat in the format specified in the script file. epsilon.eps is the resulting output in *.eps format.

The results corresponding to Figure 2 are kept in a sub-folder called 'Fig2'

- Description of 'Fig2': It has a gnuplot script for generating Fig. 2 of the paper together with the raw data called in the gnuplot script.
- Fig.2 description: Divergence of SGSF $\nabla.(\overline{\rho \boldsymbol{u} c} - \bar{\rho}\tilde{\boldsymbol{u}}\tilde{c}) \times \delta_{th}/\rho_0 s_L$ evaluated on LES and DNS grids for $\Delta/\delta_{th} = 0.4$ and $\Delta/\delta_{th} = 2.8$: (a) Case A; (b) Case D.
- Naming convention of the files in 'Fig 2 ': DIV_SGSF.gnu is the gnuplot script which reads the data contained in Gemischt_gnuplot_leXXnYYdns.dat in the format specified in the script file, where XX refers to the Lewis number and YY to the filter width. DIV_SGSF_le03.eps (DIV_SGSF_le10.eps) is the resulting output in *.eps format for subfigure 2a (2b).

The results corresponding to Figure 3 are kept in a sub-folder called 'Fig3'

- Description of 'Fig3': It has all the source MATLAB files in *.fig format for Fig. 3 of the paper.
- Fig. 3 description: (a) Correlation coefficents between $\partial(T_i^{SGSF})/\partial x_i$ and $\partial(T_i^{model})/\partial x_i$ for models GH, RF, CM, IM: $c^{\mathrm{Le},\Delta}$ (■); $c^{\Delta}(Le = 0.34)$ (■); $c^{\Delta}(Le = 0.6)$ (■); $c^{\Delta}(Le = 0.8)$ (■); $c^{\Delta}(Le = 1.0)$ (■) and $c^{\Delta}(Le = 1.2)$ (■). (b) Deviation ϵ of the conditional plots of $\partial/\partial x_i(T_i^{model})$ as defined by eq.(14). Colour-code is identical to subfigure (a). Numerical differentiation has been performed on the DNS grid for subfigures (a) and (b). Subfigures (c), (d) correspond to subfigures (a) and (b) but numerical differentiation is performed on the LES grid.
- Naming convention of the files in 'Fig 3': Fig3X.fig indicates results for subfigure "X" of figure 3.

The results corresponding to Figure 4 are kept in a sub-folder called 'Fig4 '

- Description of 'Fig4': It has all the source MATLAB files in *.fig format for Fig.4 of the paper.
- Fig. 4 description: Sketch of a planar laminar back to back flame with $Le = 1.0$: Profiles of (a) normalised density ρ/ρ_0 and reaction progress variable c. (b) filtered $\bar{c}$ and Favre filtered $\tilde{c}$ reaction progress variable, assuming a filter size of $\Delta/\delta_{th} = 2.8$; (c) magnitudes of $\partial\bar{c}/\partial x$ and $\partial\tilde{c}/\partial x$ normalized with δ_{th}. The numerical differentiation is done with respect to either the DNS grid size or the LES filter width, as indicated in the subfigure; The *x*-coordinate is normalised with

the thermal flame thickness δ_{th} in subfigures (a)-(c); (d) Semi-logarithmic plot of the one-sided amplitude spectra of $\bar{c}$ and $\tilde{c}$ as functions of the non-dimensionalised wave number.

- Naming convention of the files in 'Fig 4': Fig4X.fig indicates results for subfigure "X" of figure 4.

<u>The results corresponding to Figure 5 are kept in a sub-folder called 'Fig5 '</u>

- Description of 'Fig 5': It has all the source MATLAB files in *.fig format for Fig. 5 of the paper.
- Fig. 5 description: Relative error $(\langle\Sigma_{gen}\rangle - \langle\Sigma_{gen}^{model}\rangle)/\langle\Sigma_{gen}\rangle$ of modelled versus real total flame surface for the models T^{FU}, T^{K1}, T^{K2} as a function of filter width: $\Delta \approx 0.4\delta_{th}$ (■); $\Delta \approx 0.8\delta_{th}$ (■); $\Delta \approx 1.2\delta_{th}$ (■); $\Delta \approx 1.6\delta_{th}$ (■); $\Delta \approx 2.0\delta_{th}$ (■); $\Delta \approx 2.4\delta_{th}$ (■) and $\Delta \approx 2.8\delta_{th}$ (■). All numbers are averaged over all Lewis number cases and $\langle\cdot\rangle$ denotes volume averaging.
- Naming convention of the files in 'Fig 5': Fig5.fig indicates results for figure 5.

<u>The results corresponding to Figure 6 are kept in a sub-folder called 'Fig6 '</u>

- Description of 'Fig 6': It has all the source MATLAB files in *.fig format for Fig. 6 of the paper.
- Fig. 6 description: Deviation of conditional values of $\overline{(\rho S_d)_S \Sigma_{gen}}$, where $\Sigma_{gen}^{model} = T^{FU}, T^{K1}, T^{K2}$ and (a) $\rho_0 S_L \Sigma_{gen}^{model}$; (b) $\rho_0 S_L / Le\, \Sigma_{gen}^{model}$; (c) $\overline{(\rho S_d)}_S \Sigma_{gen}^{model}$; $\epsilon^{\mathrm{Le},\Delta}$ (■); $\epsilon^{\Delta}(Le = 0.34)$ (■); $\epsilon^{\Delta}(Le = 0.6)$ (■); $\epsilon^{\Delta}(Le = 0.8)$ (■); $\epsilon^{\Delta}(Le = 1.0)$ (■) and $\epsilon^{\Delta}(Le = 1.2)$ (■).
- Naming convention of the files in 'Fig 6': Fig6X.fig indicates results for subfigure "X" of figure 6.