1B03: MULTIPLE MAPPING CONDITIONING OF TURBULENT JET DIFFUSION FLAMES.

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In your work you have presented results for the profiles of variance of mixture fraction as predicted by CMC and by MMC. It would be important to better understand the origin of the differences between the two results. Does the MMC model imply an equation for variance of mixture fraction of the same form as the one used in CMC? Could if e.g. correspond to the same form with different values of the model constants C1 and C2 appearing in the variance equation used in CMC?

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MMC is consistent with the PDF transport equation. Our MMC solution therefore satisfies the PDF evolution equation for mixture fraction, and it is consistent with the 'standard' Reynolds averaged evolution equation for its variance (see e.g. [1]) that has been used for closure in CMC. The Reynolds averaged variance equation requires closures for (i) dissipation, (ii) production and (iii) turbulent transport, and consistency of these closures with MMC closures will provide comparable variance predictions.

(i) Dissipation: The mean dissipation needed for closure ($\overline{N}_{IJ}$ in eq. (8) in the paper) is modelled by eq. (14), the modelling constant equals unity and is consistent with our chosen modelling constant used for closure in the Reynolds averaged variance equation.

(ii) Production: A linear closure for the velocity U(ξ,x,t) (eq. (2)) requires closure of the turbulent flux, $\overline{\mathbf{v}'X_i^{'}}$, as shown in eq. (5). We have used here a gradient diffusion hypothesis and closure is therefore consistent with standard procedures.

(iii) Turbulent transport: Consistency of MMC with the variance equation requires

$$\overline{\mathbf{v}'Z''^2} = \frac{\left\langle (X_Z - \widetilde{X}_Z)^2 \xi \right\rangle}{\left\langle X_Z \xi \right\rangle} \overline{\mathbf{v}'X_Z^{'}} \qquad \text{(A.1)}$$

This equation will certainly hold if velocity and mixture fraction and X_Z and χ are joint Gaussian, and the linear closure used for the velocity U(ξ,x,t) (see (ii)) will be consistent with the second moment of the PDF transport equation independent of the closures used for the turbulent transport of $\overline{Z''^2}$ and $\left\langle X_Z \right\rangle$. We have no quantitative assessment of the validity of eq. (A.1) for DLR-A and DLR-B.

Reference:

1. T. Poinsot, D. Veynante, *Theoretical and Numerical Combustion*, Edwards, 2nd Edition, 2001, Chapter 6.