Journal of Visualization, Vol. 5, No. 4 (2002) 314

Large Eddy Simulation of Turbulent Flame

***Tominaga, T.*[1], *Itoh, Y.*[1], *Hirohata, M.*[1], *Kobayashi, T.*[1] *and Taniguchi, N.*[2]**

1) *Institute of Industrial Science, The University of Tokyo, 4-6-1 Komaba, Meguro, Tokyo 153-8505, Japan*
e-mail:tominaga@icebeer.iis.u-tokyo.ac.jp

2) *Information Technology, The University of Tokyo, 2-11-16 Yayoi, Bunkyo, Tokyo 113-8658, Japan*

(a) (b)

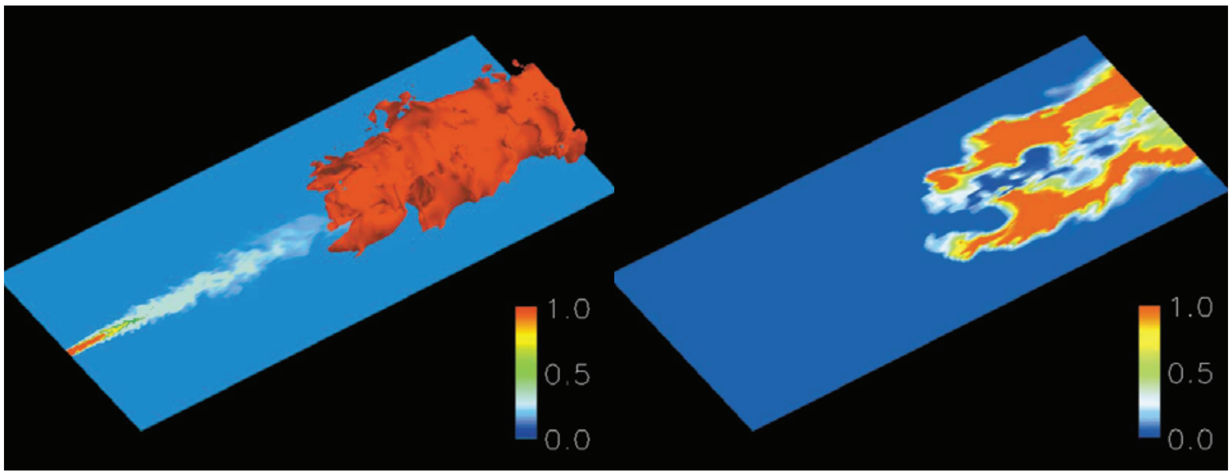

Fig.1. (a) The lifted flame front (red surface) and the mixture fraction distribution (color contour)
(b) The distribution of the scalar G

(a) (b)

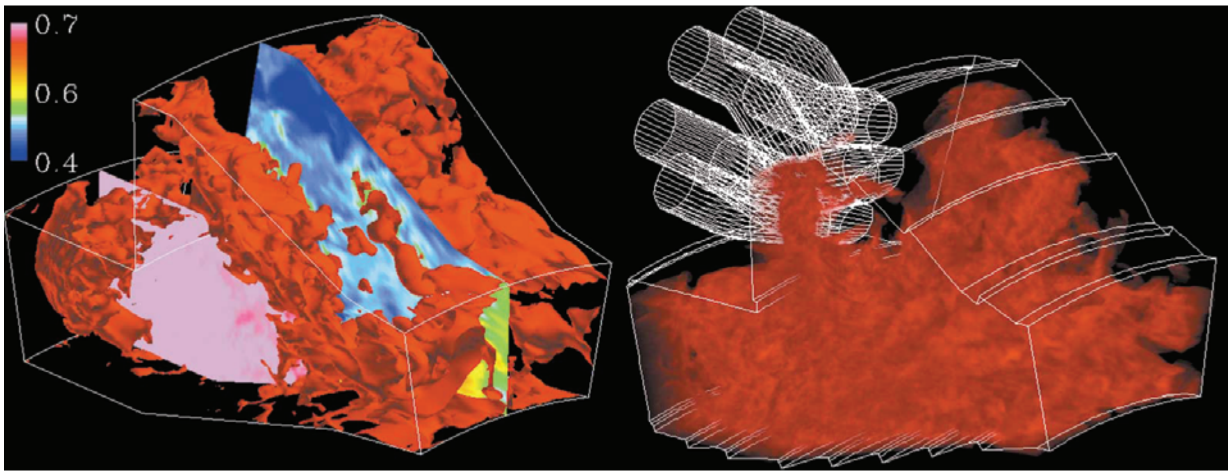

Fig.2. (a) The flame front (red surface) and the distribution of the equivalence ratio (color contour)
(b) The volume rendered flame based on the value of the scalar G

The flame front in a turbulent combustion flow field was numerically simulated using a large eddy simulation and a flamelet model. As a flamelet model, the G-equation model for a premixed combustion and the conserved scalar approach for a diffusion combustion were used respectively. Combining both equations for premixed and diffusion flame, the "2-scalar flamelet approach" was newly introduced to predict the complicated flame, such as the lifted flame and the flame propagation with non-uniform fuel ratio.

Figure 1 shows the result of the simulation for lifted flame. The mixture fraction distribution and predicted flame front are described in Fig.1(a) while the distribution of the scalar G is described in Fig.1(b).

Figure 2 shows the flame in a gas turbine combustor. In this combustor, the fuel ratio is non-uniform. Figure 2(a) shows the distribution of the equivalence ratio calculated by mixture fraction equation and the flame front calculated by the G-equation. Figure 2(b) shows the volume rendered flame based on the value of the scalar G.