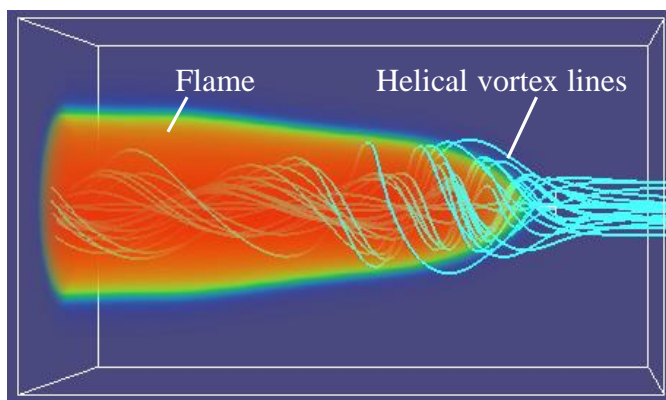


Control of Turbulence by Understanding Vortex Dynamics

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Illustration :

An example of research theme of vortex-flame interaction :
3-D numerical simulation of high-speed flame propagation along a vortex



When a line vortex or vortex ring is formed in combustible gas and ignited, the flame propagates at high speed along the vortex. Such a phenomenon is considered to occur normally in a turbulent combustion field with various-scale vortices and in a swirl combustion field with a large-scale swirl flow. Therefore, if the mechanism of this phenomenon is understood and it can be predicted and controlled, the results may be applied to combustion control of piston engines of automobiles, jet engines of aircrafts, gas turbine engines of thermal power plants, etc. Furthermore, from the perspective of disaster prevention and safety, they may also be useful in predicting and preventing fire whirls (huge-scale fire tornado phenomena).

Content :

Turbulence is a complex flow phenomenon that fluctuates in time and space. For example, most of the airflows outside bodies of automobiles and airplanes and most of the combustion gas flows inside engines of them are turbulent. However, due to its difficulty, the turbulence problem has remained unsolved for over a century, and is still one of the most important issues in fluid mechanics and combustion science.

In order to create new theories and new technologies for predicting and controlling turbulence, it is important to understand the dynamics of vortices which are the components of turbulence.

In our laboratory, therefore, vortex interactions as fundamental processes of turbulence, and vortex-flame interactions as fundamental processes of turbulent combustion are investigated by computer analysis and sometimes by hand analysis, and we aim to create a breakthrough to solve the turbulence problem.

Appealing point :

We are trying creative and fundamental researches.

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