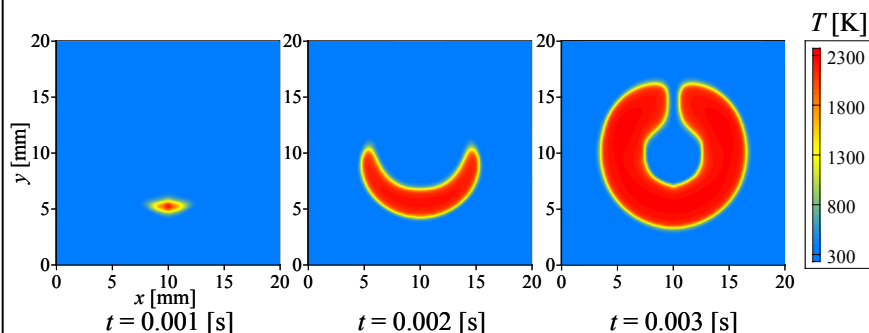


Control of Turbulence by Understanding Vortex Dynamics

Associate Professor Masahisa Shinoda

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



When a vortex ring (a circularly-closed vortex) or a line vortex (a straight vortex) is formed in combustible gas and an ignition is done, high-speed flame propagation along the vortex is seen. Such a phenomenon is thought to occur normally in turbulent combustion field and swirl combustion field. Therefore, if detail mechanism of the phenomenon is clarified, and if prediction and control of the phenomenon become possible, study results may be applied to control of piston engines of automobiles, jet engines of airplanes and gas turbine engines of thermal power plants etc. Also from a viewpoint of disaster prevention and safety, they may be helpful for predicting and preventing a fire whirl (a tornado of fire) etc.

Content:

Turbulence is temporally- and spatially-fluctuating and complex fluid flow phenomenon. For example, air flows outside bodies of automobiles and airplanes are almost in a state of turbulent flow, and gas flows inside engines of them are almost in a state of turbulent combustion. However, turbulence problem has been unsolved during more than one century because of its difficulty.

In order to create new theory and technology for predicting and controlling turbulence, it is important to well understand dynamics of vortex, which is a fundamental element of turbulence.

In our laboratory, therefore, vortex-flow interaction as a fundamental process of turbulent flow and vortex-flame interaction as a fundamental process of turbulent combustion are investigated with computational analysis, and we aim at a breakthrough for solving turbulence problem.

Yamagata University Graduate School of Science and Engineering
Research Interest : Fluid dynamics, Combustion

E-mail : shinoda@yz.yamagata-u.ac.jp
Tel : +81-238-26-3221 (Private office)
Fax : +81-238-26-3205 (Department office)
HP : <http://mipultra.yz.yamagata-u.ac.jp/>

