# Research topics

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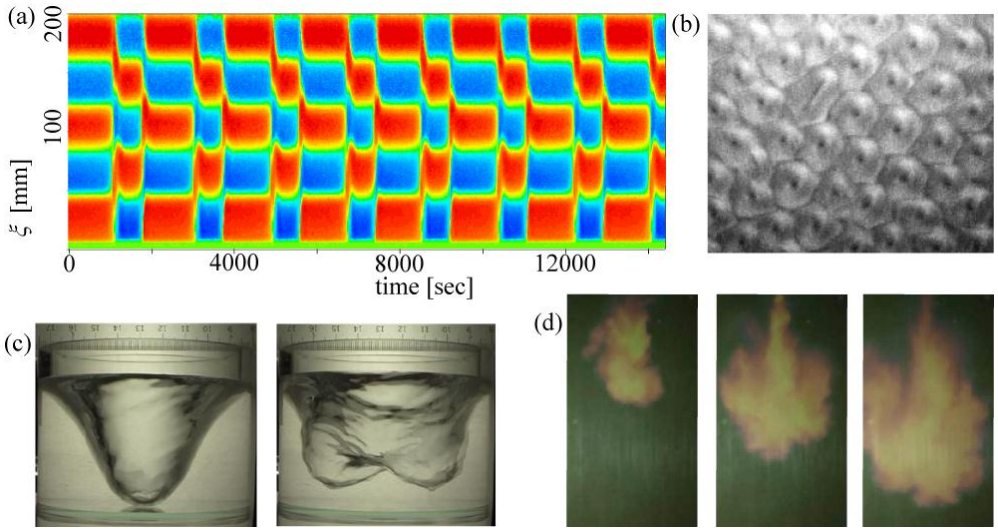
My research interests are mainly (A) flow instability and transition, and (B) development of measurement tools for experimental fluid dynamics studies. Further, Laboratory for Flow Control (LFC), a research group I belong, has a wider research field, e.g. fundamental researches of turbulent bubbly flows, frictional drag reduction by bubbles, fluid dynamics study for wind engineering, etc.

Thanks of ultrasonic velocity profiling, we can observe the velocity field inside liquid metal fluid layers. Fig. (a) shows spatio-temporal velocity field of Rayleigh-Benard convection in liquid metal layer with a horizontal magnetic field, where red and blue stripes represent five counter rotating cells align in the direction perpendicular to the magnetic field as quasi two-dimensional cell structure. These repeat spontaneous reversals and we investigate this phenomenon for fundamental understanding of Geo-dynamo. Fig. (b) shows a visualized cell pattern formation of natural convection induced by internal heating with a background rotation. This topic is also studied for a geophysical issue. Instabilities due to finite amplitude perturbation provide variety of phenomena: a rotating flow accompanied by a deformed free surface shows temporally irregular switching of the surface (Fig. (c)), where local noises generated at the tip of bottom disk dominate the global flow structure: The corresponding flow state are laminar (left) and turbulent flow (right), respectively.

As advantages, we have own measurement techniques, i.e. optical measurements including PIV, advanced post processing tools on velocity fields, ultrasonic velocity profiling for flow monitoring, and temperature field measurements based on thermo-chromic liquid crystals (e.g. Fig. (d)).




(a) Spontaneous flow reversals of convection rolls in a liquid metal layer under a magnetic field, (b) cell pattern formations of natural convection induced by internal heating with background rotation, (c) temporally irregular surface switching of rotating fluids, and (d) visualized temperature field of a thermal blob injected into a liquid gallium layer

**Research topics and main articles**

My research topics are;

1. Fundamental studies of flow instability and transition
   (a) Pattern formation, transition and heat transfer of natural convections
   (b) Subcritical flow instability
   (c) General instability problems
2. Development and application of EFD tools
   (a) Determination of fluid properties by means of ultrasonic velocity profiling
   (b) Active flow control of flows around large vessels by bubble injections for drag reduction
   (c) Heat and fluid flow measurements in liquid metals

*Keywords*: Subcritial flow instability, pattern formation of fluids, flow transition, liquid metal flows, ultrasonic velocity profiling, multi-phase flows

**Selected research articles:**

(1) T. Yanagisawa, Y. Yamagishi, Y. Hamano, **Y. Tasaka**, Y. Takeda, "Spontaneous flow reversals in Rayleigh-Bénard convection of a liquid metal" , *Phys. Rev. E*, Vol.83, 036307 (2011)

(2) **Y. Tasaka**, T. M. Schneider, T. Mullin, "The Folded Edge of Turbulence in a Pipe", *Phys. Rev. Lett.*, Vol.105, Issue 17, 174502(2010) (4 pages).

(3) J. Takahashi, **Y. Tasaka**, Y. Murai, Y. Takeda, T. Yanagisawa, "Experimental study of cell pattern formation induced by internal heat sources in a horizontal fluid layer", *Intl. J. Heat & Mass Trans.*, Vol.53, pp.1483-1490(2010)

(4) **Y. Tasaka**, M Iima, "Flow transition in the surface switching of rotating fluid", *J. Fluid Mech.*, Vol. 636, pp.475-484 (2009)

(5) **Y. Tasaka**, Y. Takeda, T. Yanagisawa, "Ultrasonic visualization of thermal convective motion in a liquid gallium layer", *Flow Meas. Inst.*, Vol. 19/3-4, pp.131-137 (2008)