TOPOLOGICAL FLUID DATA ANALYSIS: COT REPRESENTATIONS OF SURFACE FLOWS AND THEIR IMPLEMENTATIONS

Tomoo Yokoyama

Kyoto University of Education Department of Mathematics / Japan Science and Technology Agency, 1 Fujinomori, Fukakusa, Fushimi-ku Kyoto 612-8522 Japan

We introduce topological methods, called a partially Cyclically Ordered rooted Tree (COT) representation, for analyzing 2D flows. First, we present the theoretical background and applications of our methods. In particular, applying COT representations to a plate in a time-dependent vortex flow under mild conditions, we can estimate when the lift-to-drag ratios of the plate are maximal and can determine the intermediate topologies of the vortex flow. Moreover, we discuss their implementations and the relative works. The contents of this talk is based on the joint works with Takashi Sakajo (Kyoto University) and Tomoki Uda (Tohoku University). References

[1] T. Sakajo, T. Yokoyama, Tree representations of streamline topologies of structurally stable 2D incompressible flows, IMA Journal of Applied Mathematics, Volume 83, Issue 3 (2018), pp. 380–411.
[2] T. Sakajo, T. Yokoyama, Transitions between streamline topologies of structurally stable Hamiltonian flows in multiply connected domains, Physica D, 307 (2015) pp. 22–41.
[3] T. Yokoyama, T. Sakajo, Word representation of streamline topology for structurally stable vortex vector fields in mutiply connected domains, Proceedings of the Royal Society of London. Series A., 8 February 2013 469 no. 2150 20120558