

## ***Topology optimization for flow field designs***

Kentaro Yaji

Department of Mechanical Engineering, Osaka University  
2-1, Yamadaoka, Suita, Osaka, 565-0871, JAPAN  
E-mail: yaji@mech.eng.osaka-u.ac.jp

### ***Abstract***

Topology optimization has been widely studied and drastically developed, since Bendsøe and Kikuchi [1] first proposed its basic idea and concept in 1988. It can be safely said that its versatility is the reason why this research community widely spread in all over the world. Among the previous works, the application to fluid flow problems is relatively new topic in the research field of topology optimization.

In this talk, I will briefly explain the basic concept and mathematical framework of fluid topology optimization [2] and introduce the related pioneering works that focus on generating optimized flow fields/channels. Then, I will provide several research results that aims to solve fundamental flow field design problems, and practical engineering design problems such as heatsink and flow battery designs [3,4]. We finally discuss the future direction of fluid topology optimization.

### ***References***

- [1] M. P. Bendsøe and N. Kikuchi, “Generating optimal topologies in structural design using a homogenization method”, *Comput. Methods Appl. Mech. Eng.*, 1988, 71(2): 197–224.
- [2] T. Borraavall and J. Petersson, “Topology optimization of fluids in Stokes flow”, *Int. J. Numer. Meth. Fluids*, 2003, 41(1): 77–107.
- [3] K. Yaji, T. Yamada, S. Kubo, K. Izui and S. Nishiwaki, “A topology optimization method for a coupled thermal-fluid problem using level set boundary expressions”, *Int. J. Heat Mass Trans.*, 2015, 81: 878–888.
- [4] K. Yaji, S. Yamasaki, S. Tsushima, T. Suzuki and K. Fujita, “Topology optimization for the design of flow fields in a redox flow battery”, *Struct. Multidisc. Optim.*, 2018, 57(2): 535–546.