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**Dissimilar control of momentum and heat transfer in wall turbulence with traveling wave-like wall blowing and suction** YOSUKE HASEGAWA, Center of Smart Interfaces, TU Darmstadt, NOBUHIDE KASAGI, Dept. Mech. Eng., The Univ. Tokyo, CENTER OF SMART INTERFACE, TU DARMSTADT COLLABORATION, DEPT. MECH. ENG., THE UNIV. TOKYO COLLABORATION — Because of the importance of fundamental knowledge on turbulent heat transfer for further decreasing entropy production and improving efficiency in various thermo-fluid systems, we revisit a classical issue whether enhancing heat transfer is possible with skin friction reduced or at least not increased as much as heat transfer. The answer that numerous previous studies suggest is quite pessimistic because the analogy concept of momentum and heat transport holds well in a wide range of flows. In the present study, we introduce the suboptimal control theory for achieving dissimilar control in one of the most canonical thermo-fluid system, namely, turbulent flow with heat transfer in a smooth and straight channel. The Fréchet differentials obtained clearly show that the responses of velocity and temperature fields to a given control input are quite different due to the fact that the velocity is a divergence-free vector while the temperature is a conservative scalar. By exploiting this inherent difference, the dissimilar control can be achieved even in flows where the averaged momentum and heat transport equations have the same form.

Yosuke Hasegawa
Center of Smart Interfaces, TU Darmstadt

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