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Feedback control of wall turbulence for drag reduction with finite spatial and temporal resolution BETTINA FROHNAPFEL, ALEXANDER STROH, TU Darmstadt, YOSUKE HASEGAWA, NOBUHIDE KASAGI, The University of Tokyo — Among various active control strategies, feedback control generally offers better control performance with smaller power consumption than predetermined control. However, it has the disadvantage of requiring numerous sensors which detect the instantaneous flow state and produce signals that are used to trigger actuators. In addition, measurable flow quantities are likely to be limited to those at the wall, where sensors can be implemented without changing the system design drastically. Most feedback control algorithms so far proposed, assume that massively arrayed sensors and actuators are provided on a wall surface. Considering the fact that physical dimensions and response times of these hardware components should be very small, i.e., less than millimeter and millisecond, fabrication and maintenance of these devices would impose an unbearable cost even with rapidly developing MEMS technology. In the present study, we take into account finite spatial and temporal resolution of wall sensing in numerical simulation and show how it affects the control results. In addition, based on the knowledge of the regeneration cycle of near-wall turbulent structures, we propose a control algorithm which yields considerable control performance with comparitively low spatio-temporal resolution.

Bettina Frohnapfel
TU Darmstadt

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