Abstract Submitted
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Active control of deterministic turbulent spots for drag reduction[1] KWING-SO CHOI, YAXING WANG, University of Nottingham, MICHAEL GASTER, CHRIS ATKIN, City, University of London, YURY KACHANOV, VLADIMIR BORODULIN, ITAM — A series of experiments was carried out using Gaster's wind tunnel at City, University of London, where the freestream turbulence level in the test section was extremely low (0.006% between 2 Hz and 2 kHz). With weak excitations applied from spanwise-periodic 19 miniature speakers located downstream of a flat-plate leading edge, the boundary-layer development was studied in detail using a hot-wire anemometer at laminar, transitional and turbulent stages. Careful velocity measurements revealed an appearance of turbulent spots, which were precisely reproducible in both time and space each time the pseudo-random signal was applied. The emergence of turbulent spots, which bypassed a full development of T-S waves, was deterministic at least in the lower frequency range of velocity signals, enabling us to examine their structure that was not possible before. Opposition control was then carried out by issuing wall-normal jet on the high-speed region of turbulent spots with a view to achieve a skin-friction reduction by delaying transition to fully-developed turbulence. This was done without sensors as all boundary-layer structures were "deterministic".

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