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**Equilibrium turbulent boundary layers with wall suction/blowing and pressure gradients** SAURABH PATWARDHAN, O.N. RAMESH, Indian Institute of Science — Conditions for the equilibrium conditions in turbulent boundary layers with suction or blowing across a no slip wall and pressure gradients are derived from the governing equations. It is also shown that under these conditions the governing equations show self similarity in the conventional inner co-ordinates as well as “laminar-like” co-ordinates. The only turbulent boundary layer in “perfect equilibrium” known as sink flow turbulent boundary layer forms a subset of this more general equilibrium concept. Direct numerical simulations were carried out to investigate this hypothesis for the case of favourable pressure gradient with small blowing at the wall. Reynolds number invariance and complete self similarity of mean velocity profile and second order turbulence statistics is observed along the flow direction similar to the sink flow boundary layer. A comparison between the case with wall blowing and imposed favourable pressure gradient and the sink flow case for same value of pressure gradient parameter reveals a shift in log law in mean velocity profile and increase in peak turbulence intensities.

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