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Scaling laws of turbulent Couette flow with wall-normal transpiration STEPHANIE KRAHEBERGER, MARTIN OBERLACK, Tech Univ Darmstadt, SERGIO HOYAS, Universidad Politcnica de Valencia — An extensive DNS study of turbulent plane Couette flows with permeable boundary conditions, i.e. wall-normal transpiration, was conducted at $Re_\tau = 250, 500, 1000$ and varying transpiration velocities v_0. The discretization employed is speudo-spectral in wall-parallel and compact finite differences in wall-normal direction (see Hoyas et al., Phys. Fluids 2006). We derived a global stress relation for the flow, balancing total shear stresses, with very different friction velocities at lower and upper wall. This, in turn, was used to validate convergence of DNS statistics. Most important, we derived a viscous sublayer velocity scaling for the suction wall employing asymptotic methods. Moreover, using Lie group symmetry analysis applied to the multi-point correlation equation we derived scaling laws for the near-wall region on the blowing wall and the channel center, predicting mean velocity $\langle U_1 \rangle$ and the Reynolds-stress components $\langle u_i u_j \rangle$, (see Oberlack et al., JSME Mech. Eng. Rew., 2015), which were nicely validated against DNS data.

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