Demo: 2D laminar plane channel flow

Numerical Flow Simulation

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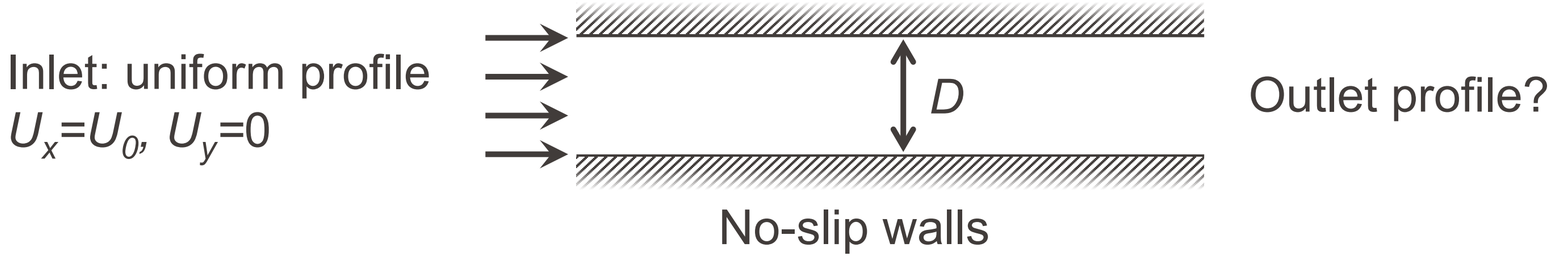
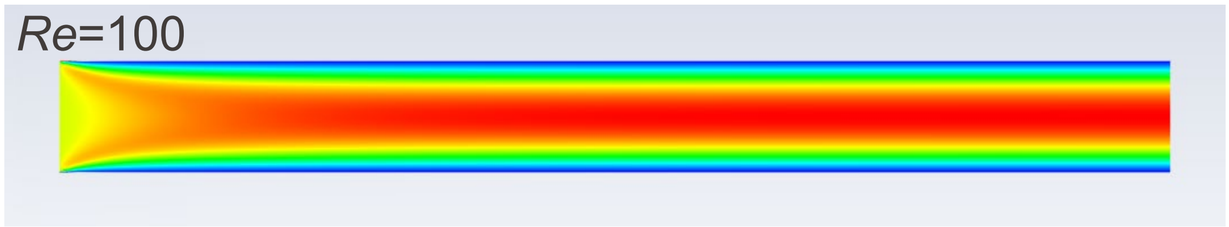
2D laminar plane channel flow

- Sketch:

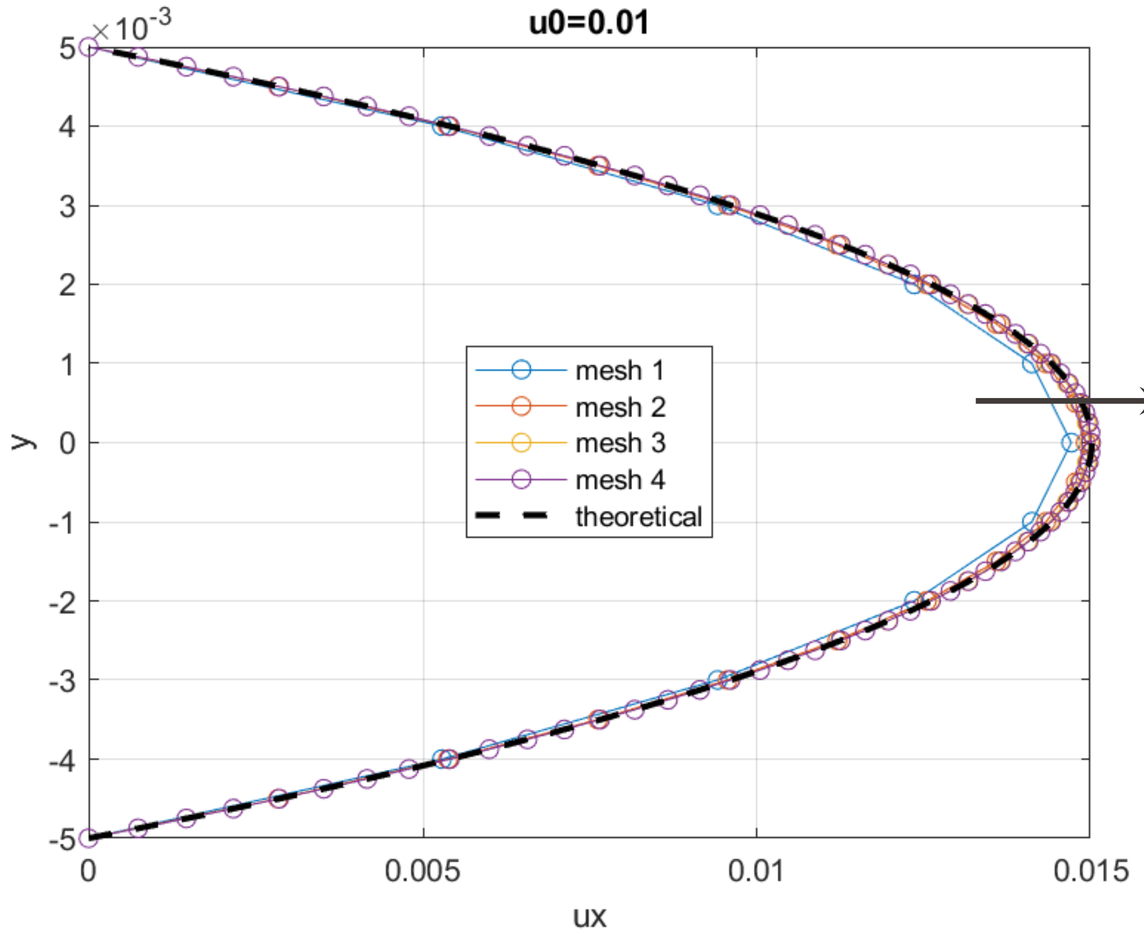


- Operating conditions: laminar regime (*Re* < approx. 1000)
- Dimensions and physical properties: e.g. D=1 cm, U_0=1 cm/s, water ν=1e-6 m^2/s → Re=$U_0.D/\nu$=100



Effect of mesh size

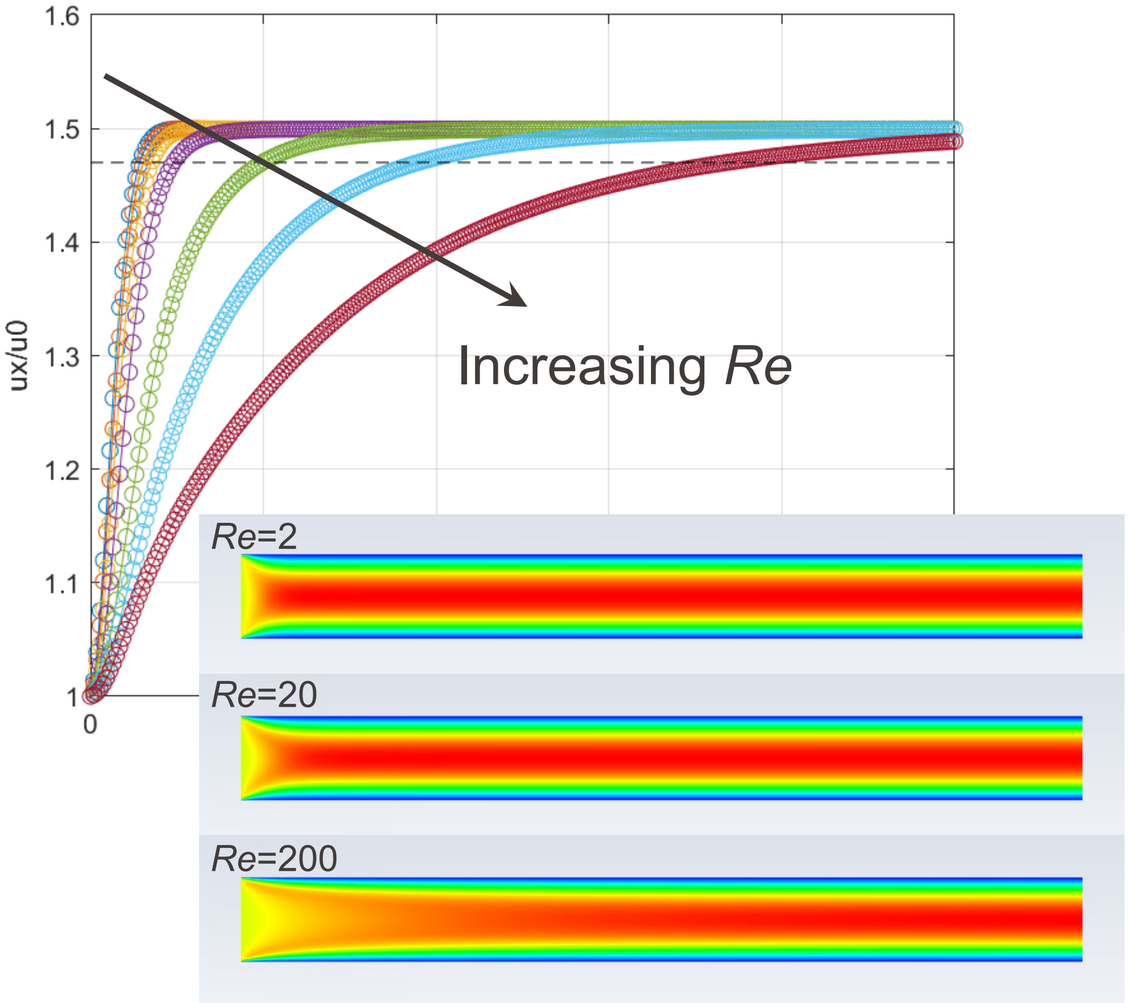
- As the mesh is refined, the numerical velocity profile at the outlet gets closer to the theoretical fully-developed profile (Poiseuille, parabolic):



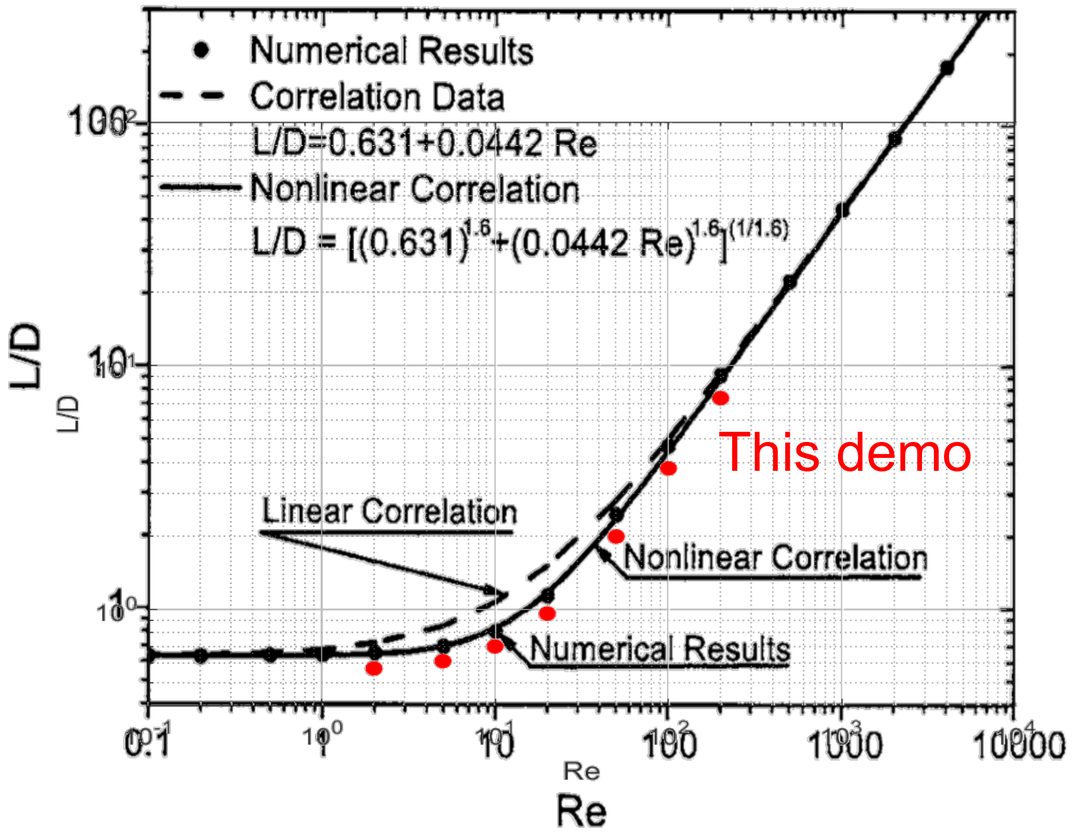
Finer mesh (structured mesh with N_y=10, 20, 40, 80 quadrilateral elements across channel height)

Effect of Reynolds number

- Centerline velocity:



- "Entry length" to reach developed profile:



Durst, Ray, Ünsal and Bayoumi, J. Fluids Eng., 2005