Discontinuous Galerkin Methods for the Navier-Stokes Equation

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1. Numerical Example

The first test problem has been used by many researchers. We provide the results for a problem of driven cavity flow with boundary conditions

$$\mathbf{u}|_{\partial\Omega} := \begin{cases} \mathbf{1} & \text{if } y = 1, \\ \mathbf{0} & \text{else,} \end{cases}$$

and $\mathbf{f} = \mathbf{0}$.

Suppose $\nu = 1$, Fig. 1 shows the numerical velocity and pressure with structural $2 \times 32 \times 32$ triangular mesh.

The second problem is the flow in a channel. We use FreeFem++ to generate unstructural triangular mesh. The total number of degrees of freedom equal to 31500 (2100 elements $\times$ 15 local d.o.f). Fig. 2 and 3 shows the numerical velocity and pressure, respectively.

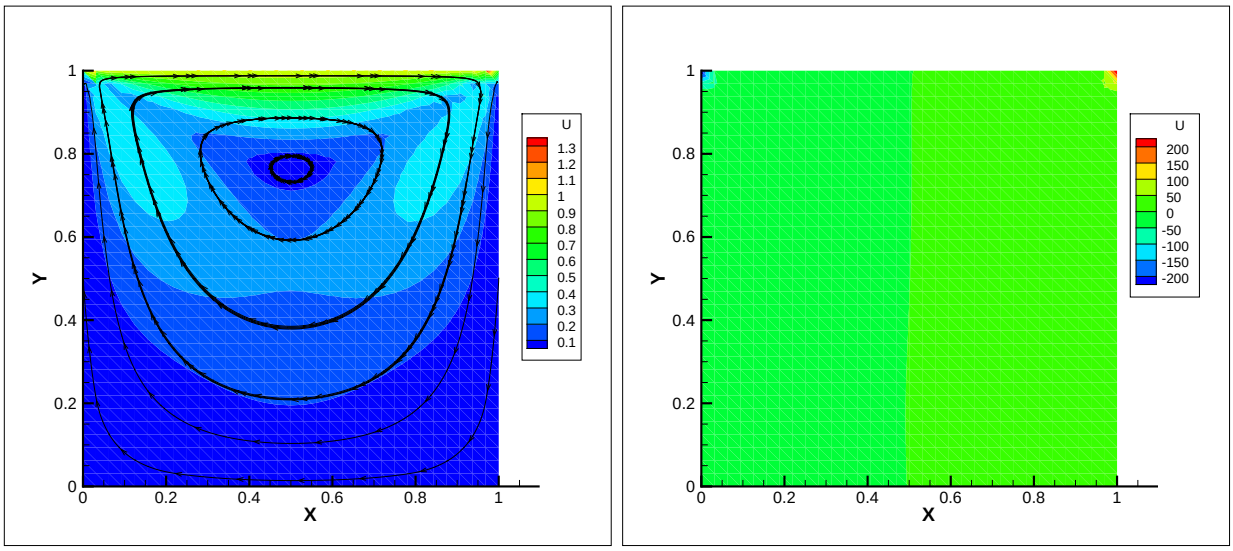

Fig. 1: Numerical velocity and pressure for driven cavity flow with NIPG 1

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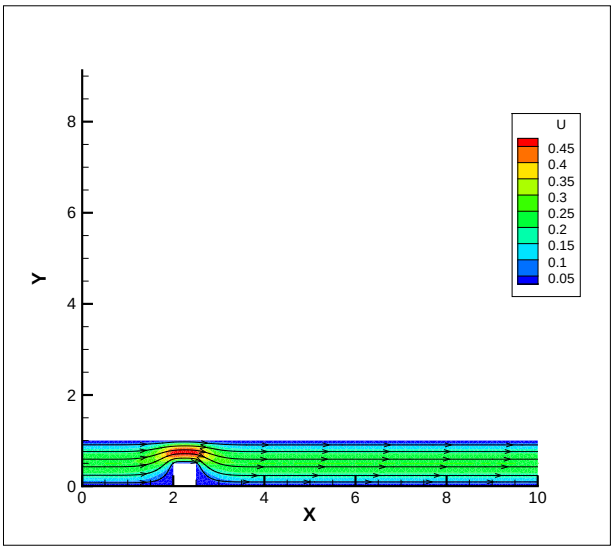

Fig. 2: Numerical velocity for step channel problem with NIPG 1

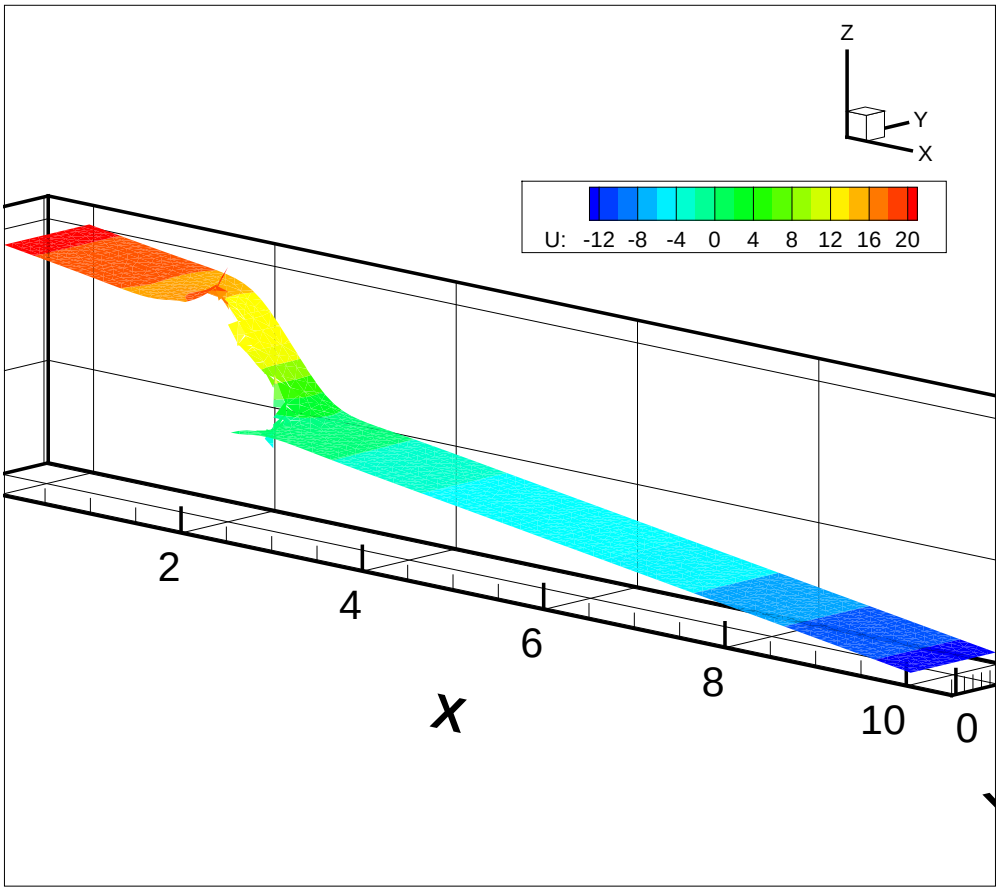

Fig. 3: Numerical pressure for step channel problem with NIPG 1