Demonstration of Paraview

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Abstract

Paraview:

- Brief tutorial for visualization

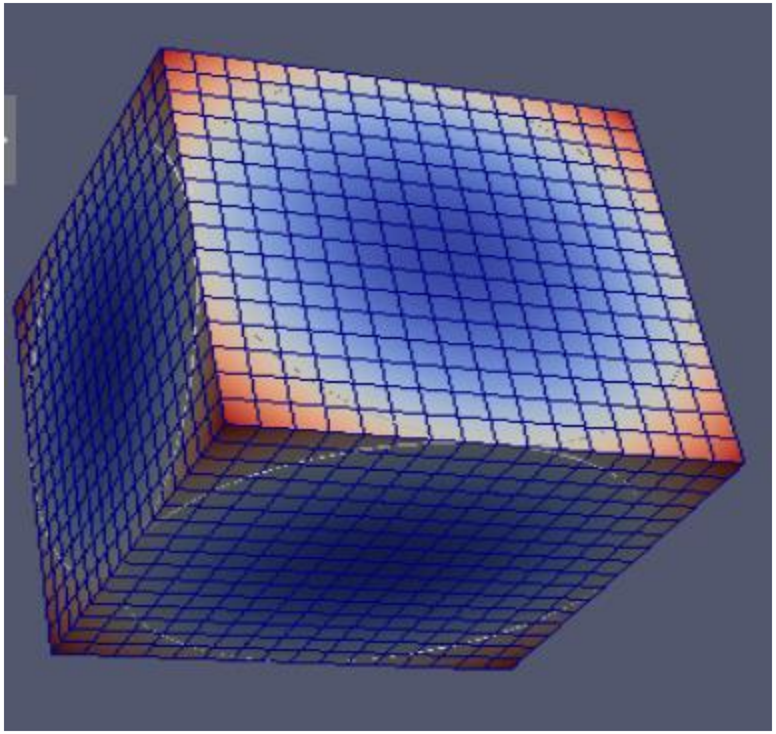
2D

3D

Introduction

Paraview:

- ❖ Demonstration of 2D and 3D file
- ❖ Explain step 57



Step-57

Navier Stokes equation:

$$-\nu\Delta\mathbf{u} + (\mathbf{u}\cdot\nabla)\mathbf{u} + \nabla p = \mathbf{f}$$
$$-\nabla\cdot\mathbf{u} = 0.$$

Linearization:

$$F(\mathbf{u}, p) = \begin{pmatrix} -\nu\Delta\mathbf{u} + (\mathbf{u}\cdot\nabla)\mathbf{u} + \nabla p - \mathbf{f} \\ -\nabla\cdot\mathbf{u} \end{pmatrix}.$$

Newton's iteration on a vector function can be defined as

$$\mathbf{x}^{k+1} = \mathbf{x}^k - (\nabla F(\mathbf{x}^k))^{-1} F(\mathbf{x}^k),$$

Final Linearization system

$$-\nu\Delta\delta\mathbf{u}^k + \mathbf{u}^k\cdot\nabla\delta\mathbf{u}^k + \delta\mathbf{u}^k\cdot\nabla\mathbf{u}^k + \nabla\delta p^k = -F(\mathbf{x}^k),$$
$$-\nabla\cdot\delta\mathbf{u}^k = \nabla\cdot\mathbf{u}^k,$$

Initial Guess

$$-\nu_1\Delta\mathbf{u} + (\mathbf{u}\cdot\nabla)\mathbf{u} + \nabla p = \mathbf{f},$$
$$-\nabla\cdot\mathbf{u} = 0,$$

Preconditioner

$$\begin{pmatrix} A & B^T \\ B & 0 \end{pmatrix}\begin{pmatrix} U \\ P \end{pmatrix} = \begin{pmatrix} F \\ 0 \end{pmatrix}.$$

Test case

$$(u(x,y), v(x,y)) = (1,0) \qquad \text{if } y = 1$$
$$(u(x,y), v(x,y)) = (0,0) \qquad \text{otherwise.}$$

Thank You