TITLE – SESSION2

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Agenda

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- Mesh convergence
- Divergence schemes
- Hands on: Grid convergence vs divergence scheme for the case of laminar flow in 2D U-bend

Mesh convergence

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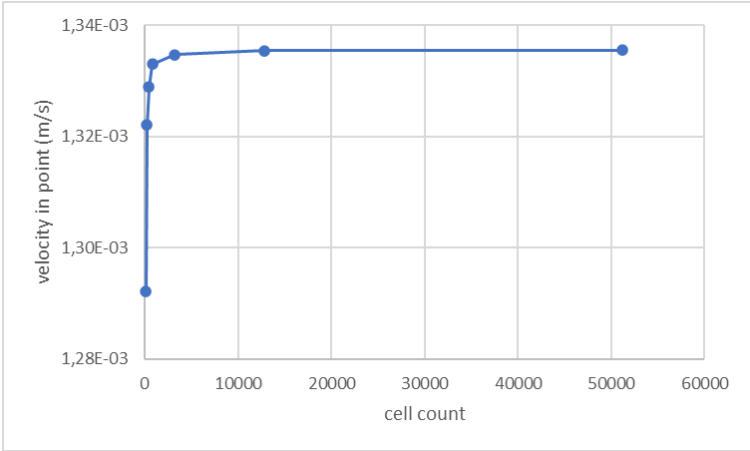
- Let's play…

2D, laminar,isothermal, steady state, Re=700, domain 0.7m×7m

- Velocity in a point (x=0.35m, y=6.5m) of converged vs mesh density
- All quadrilateral cell sqewness=1, AR=5, GR=1



- Results of the simulation should always be mesh independent!

Mesh convergence

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Simplified Richardson extrapolation

- Is a procedure to evaluate mesh independance
- Perform the same simulation on three meshes with mesh density ratio of 1:2:4
- Export the value of a variable in a point for all three simulations (say f)
- $f_1 = value\ on\ fine\ mesh, f_2 = value\ on\ middle\ mesh, f_3 = value\ on\ coarse\ mesh$
- Define factor of refinement r=2
- Compute rank of discretization $p = \ln\left((f_3 - f_2)/(f_2 - f_1)\right) / \ln(r)$
- Compute extrapolated value $f_{ex} = \frac{f_1 - (f_2 - f_1)}{r^p - 1}$
- Compute $RDE_z = \frac{f_z - f_{ex}}{f_{ex}}$

Divergence schemes

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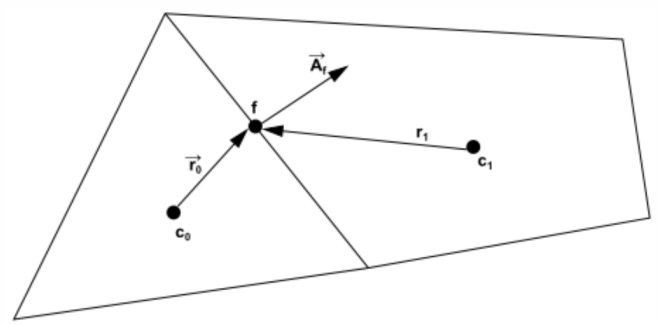
- Remember 2nd session of yesterdays program
  - We limit or self to the convection term

$$\int_V \frac{\partial \rho\varphi}{\partial t} dV + \oint \rho\varphi\vec{v}\cdot d\vec{A} = \oint \Gamma_\varphi \nabla\varphi \cdot d\vec{A} + \int_V S_\varphi dV$$

$$\frac{\partial \rho\varphi}{\partial t} V + \sum_f^{N_{faces}} \rho_f \vec{v}_f \varphi_f \cdot \vec{A}_f = \sum_f^{N_{faces}} \Gamma_\varphi \nabla\varphi_f \cdot \vec{A}_f + S_\varphi V$$



$$\varphi_{f,FOU} = \varphi_{c1}$$

$$\varphi_{f,SOU} = \varphi_{c1} + \nabla\varphi \cdot \overrightarrow{r_1}$$

Hands on: U-bend

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- Use meshes similar to the one from Session1
- Prepare and execute the simulations for given case on all meshes for FOU and SOU
- Compare the results

Thank you for your attention!

http://sctrain.eu/

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