Ajay Gupta  →  Calculate measurement errors w/ thermocouples

Mukesh  →  Calculate V and T in spiral hx. Compare Laminar/Turbulent Solutions

Purshat  →  Fuel cell reformer?

Pong  →  Fluid Flow Fluid Flow?

Yang  →  Driven Cavity problem

Yong Li  →  Fluid – Fluid Flow?

Guo  →  Fluid – Flow in cavity

Lu  →  Fluid – fluid problem (geology)

Ting  →  Heat Transfer?

Junf  →  Paper – Mathematical/Design basis for?

Lee  →  Paper ↔ Airfoils?

Boddewar  →  Fluid – orifice asymmetric turbulent?

Kalyan  →  Fluid – natural convection in heated cavity or convective
Two Topics
1) penalty method \(\leftrightarrow\) relaxation iterative solution (Py 448)

\[ p = -\lambda \left( \frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} \right) \]

- substitute into momentum equations
- solve as \(\lambda \to \infty\) omitting continuity eqn

\[
\begin{bmatrix}
C_{11} + C_{22} & 0 \\
0 & C_{11} + C_{22}
\end{bmatrix}
\begin{bmatrix}
u1 \\
v2
\end{bmatrix}
+ \begin{bmatrix}
2k_{11} + k_{22} & k_{12} \\
k_{12} & k_{11} + 2k_{22}
\end{bmatrix}
\begin{bmatrix}
u1 \\
v2
\end{bmatrix}
+ \begin{bmatrix}
L_{11} & L_{12} \\
L_{21} & L_{22}
\end{bmatrix}
\begin{bmatrix}
u1 \\
v2
\end{bmatrix}
= \begin{bmatrix}
\frac{R_u}{R_v}
\end{bmatrix}
\]

\[ L_{11} = \int_{\Omega} \left\{ \frac{\partial N}{\partial x} \right\} \left\{ \frac{\partial N}{\partial x} \right\} \, d\Omega \quad \text{etc.} \]
\[
\begin{pmatrix}
L_{11} & L_{12} \\
L_{12}^T & L_{22}
\end{pmatrix} = X \quad \text{for } \{N_p\} = 1
\]

\[L = \{L_1\} \quad \text{on page 444}\]

Iterative solver we had before is some as penalty formulation.

\[A = [C] + [K]\]

\[
\bar{A} = A + ALL^T
\]

2) Upwind modifications

Galerkin M.W.R. statement.

\[
\int_{\Omega} R W_i \, d\Omega
\]

residual weight

Galerkin - Let \( W_c = N_c \) shape functions

If modify shape functions in the "upstream" direction, we can introduce upwinding to smooth flow.
Pepper & Heinrich, pg 198.

Let \( W_i = N_i(x) + \left( \frac{\beta}{2} \right) \frac{dN_i}{dx} \)

\( \beta \) depends on the strength of the flow (magnitude \( V \)).

Project Deadline: Thursday, Dec 12.