Validation Cases

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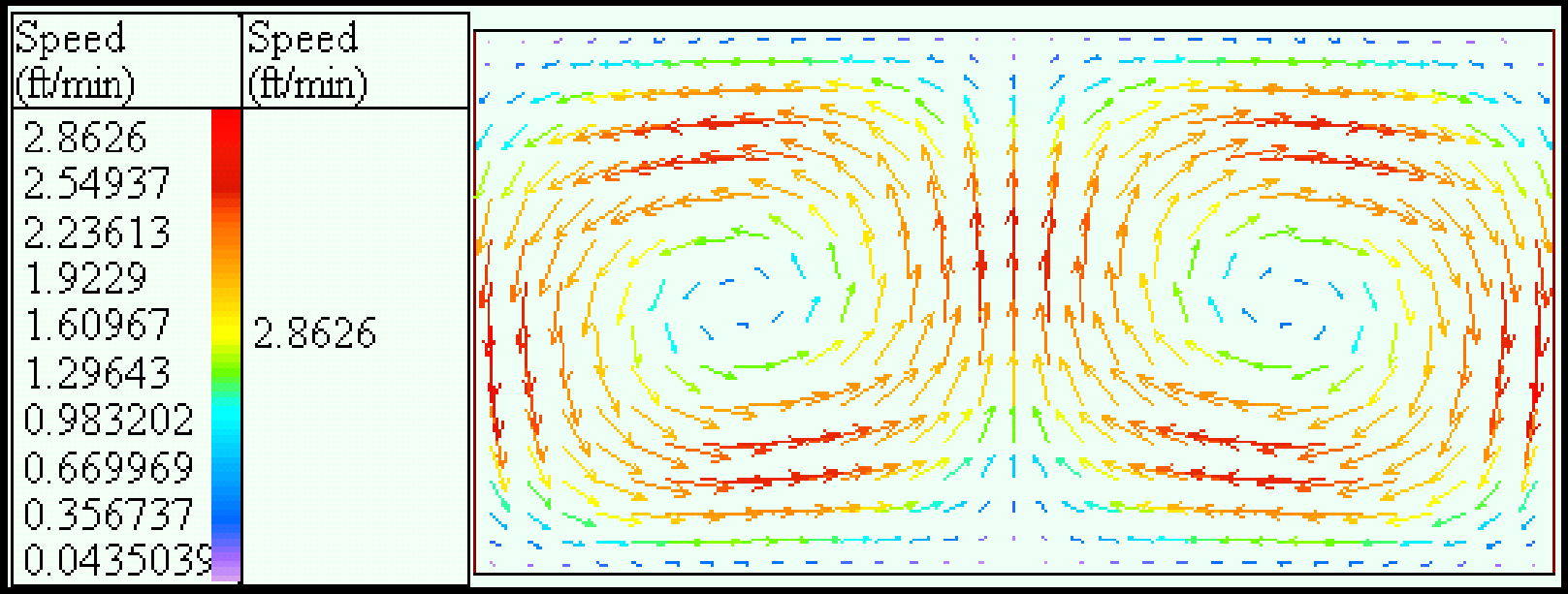
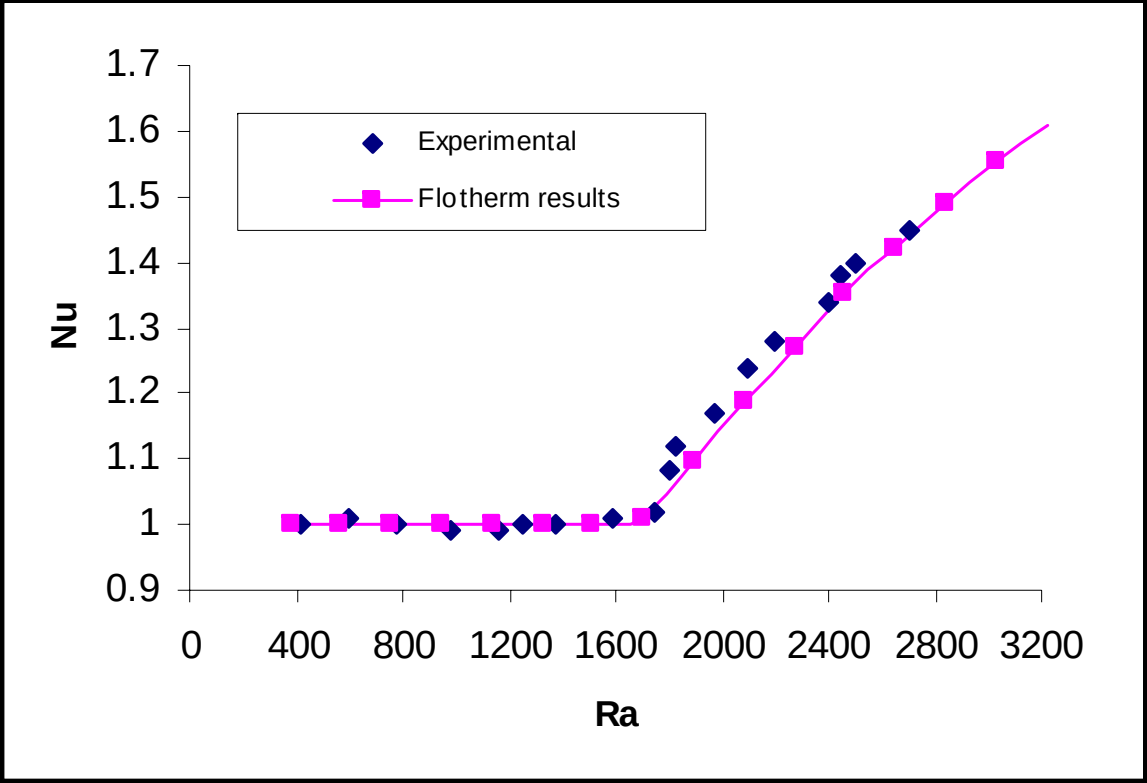
Bernard Convection

- Cold wall above, Hot Wall below



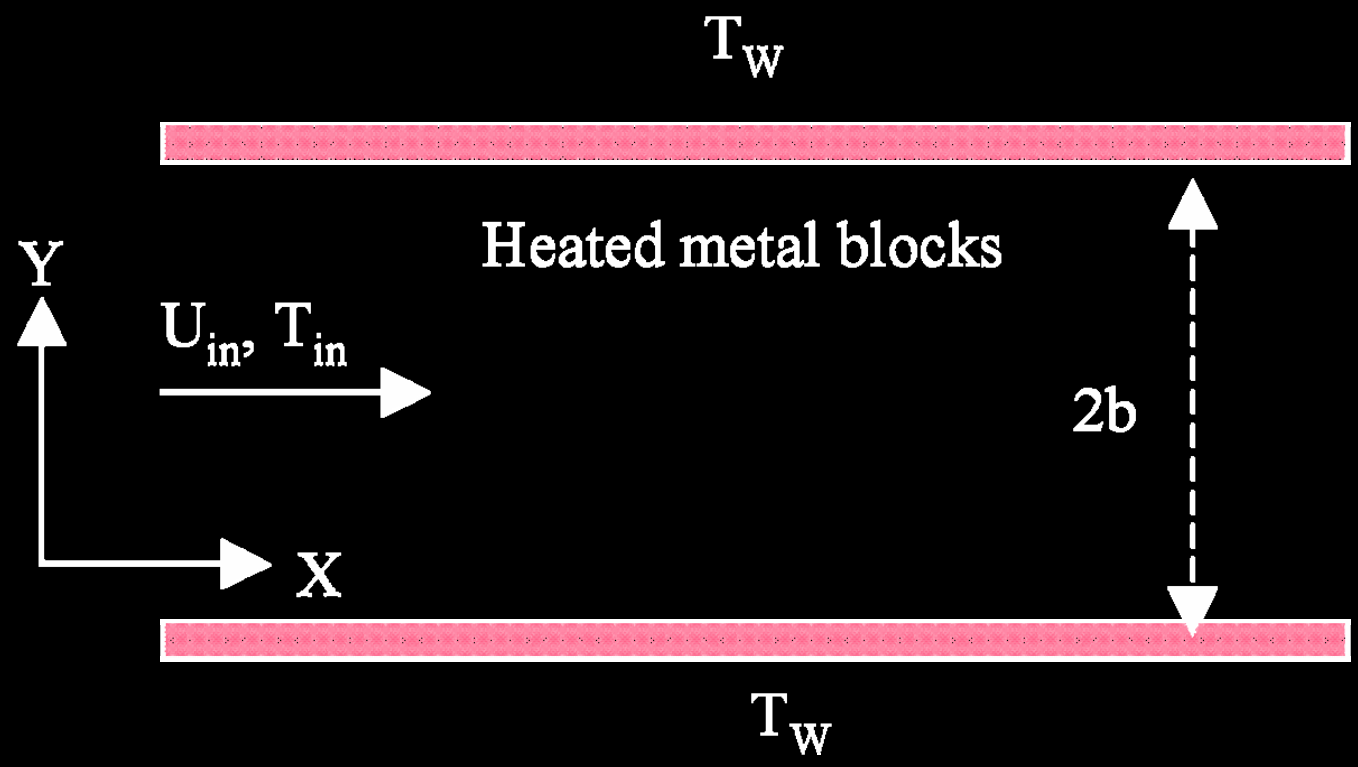
Bernard Convection

- Results:



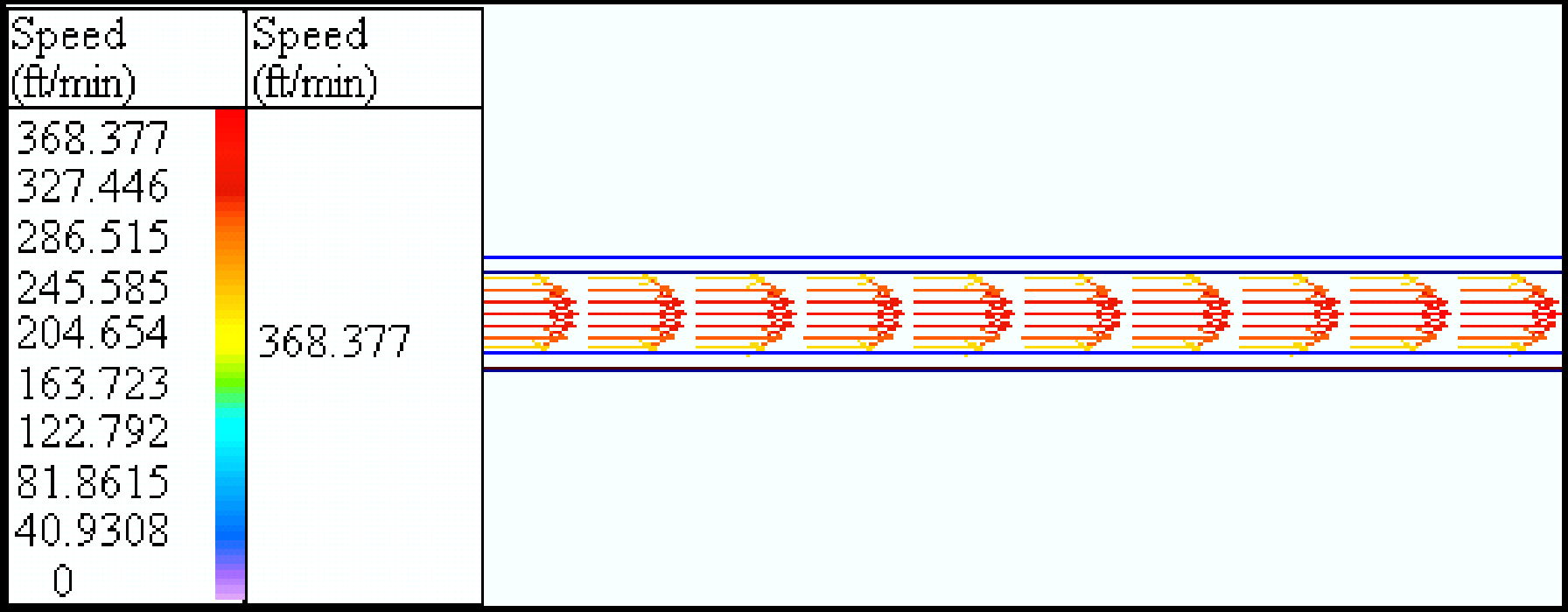
Flat Plates

- Geometry:



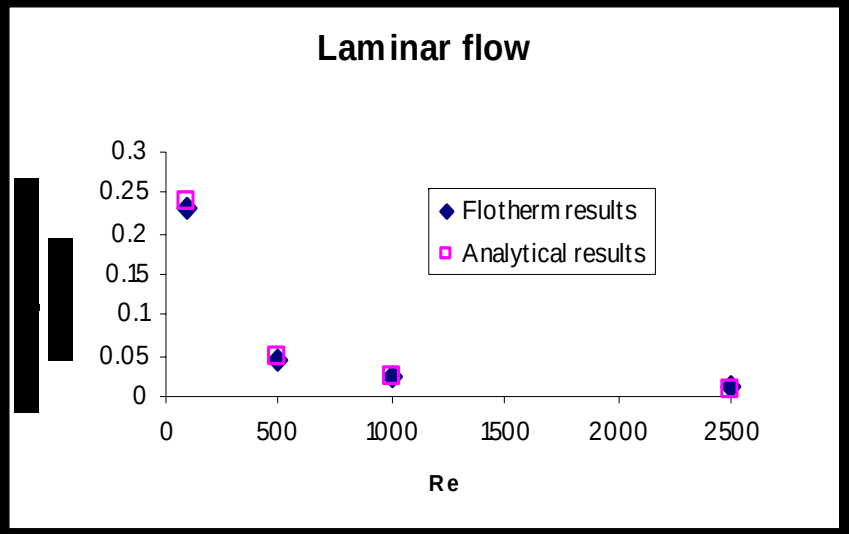
Flat Plates

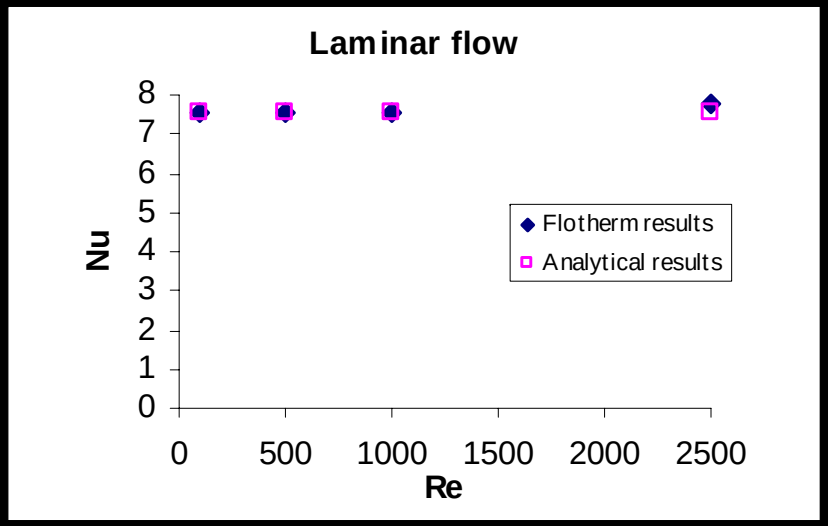
- FLOTHERM:



Flat Plates - Laminar

- Comparison with analytical results:



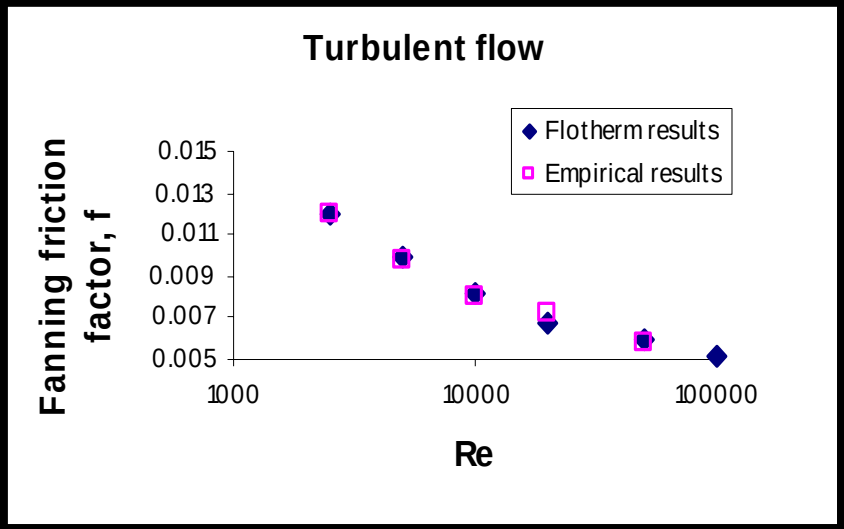


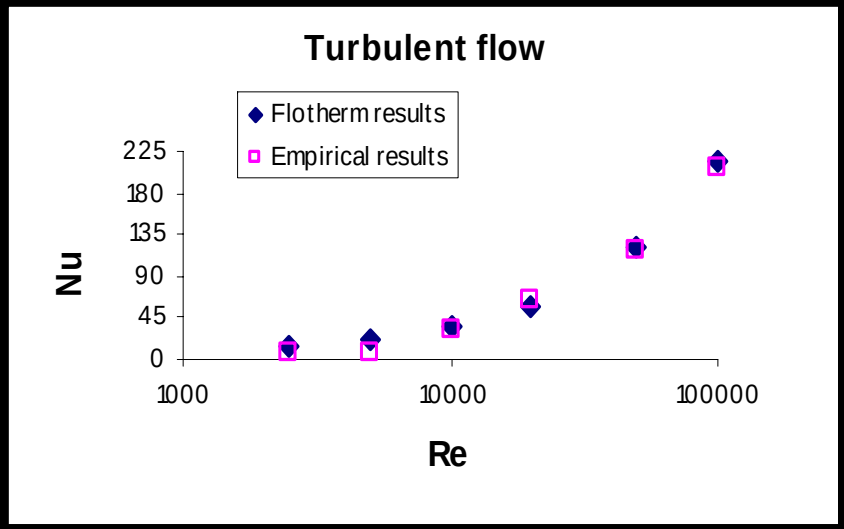
$$f = \frac{24}{\mathrm{Re}}$$

$$Nu = 7.54$$

Flat Plates - Turbulent

- Comparison with empirical results:





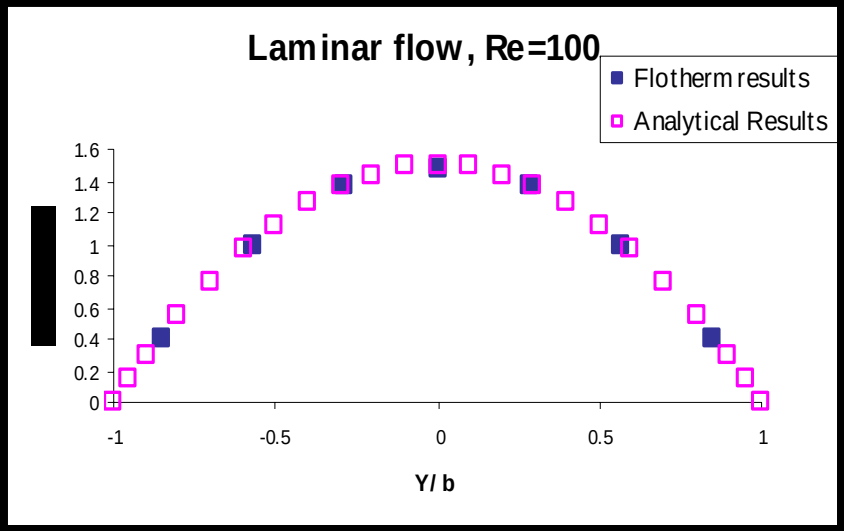
$$f = \frac{0.1268}{\mathrm{Re}^{0.3}} \qquad 5000 < \mathrm{Re} < 30000$$

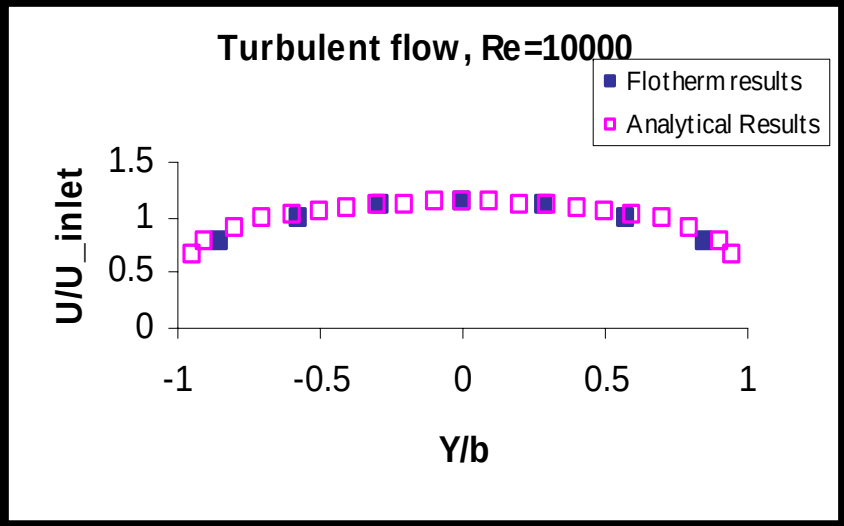
$$f = \frac{0.0868}{\mathrm{Re}^{0.25}} \qquad 12000 < \mathrm{Re} < 1.2 \times 10^{6}$$

$$Nu = 0.023\,\mathrm{Re}^{0.8}\,\mathrm{Pr}^{0.3}$$

Flat Plates

- Flow profiles





- Analytical

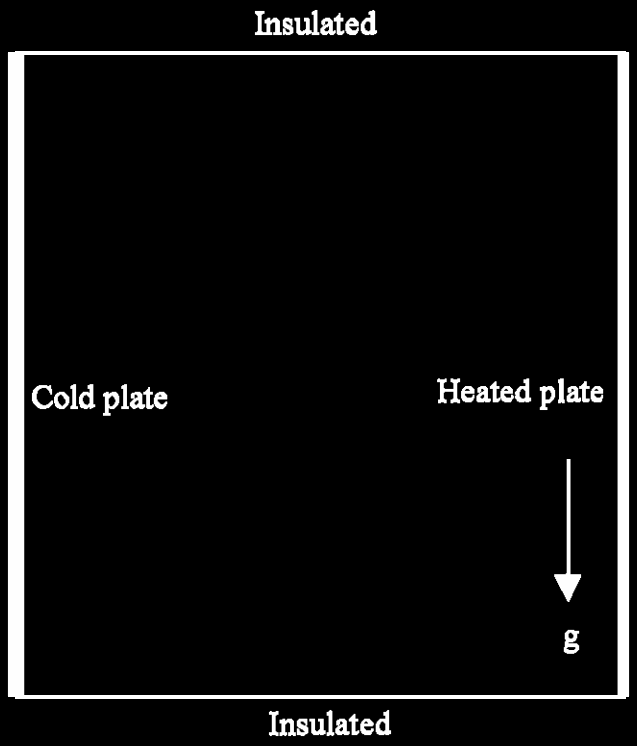
$$\frac{U}{U_{in}} = \frac{3}{2}\left(1-\left(\frac{y}{b}\right)^2\right)$$

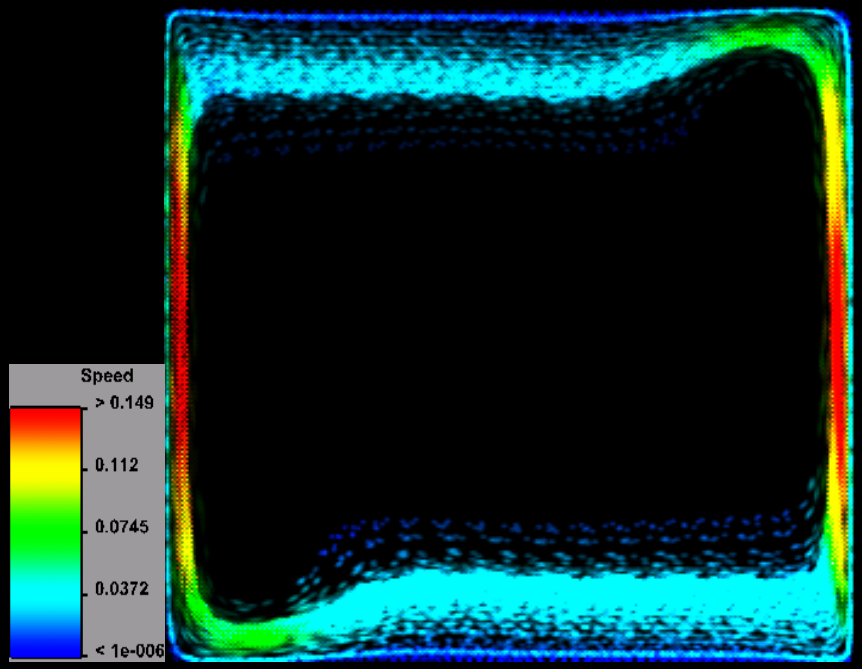
- Empirical

$$\frac{U}{U_{in}} = 1+\left((f/2)^{0.5}/K_2\right)\left(\frac{5}{6}+\log\left(1-(y/b)^{0.5}\right)+(y/b)^{0.5}\right)$$

Closed Cavity

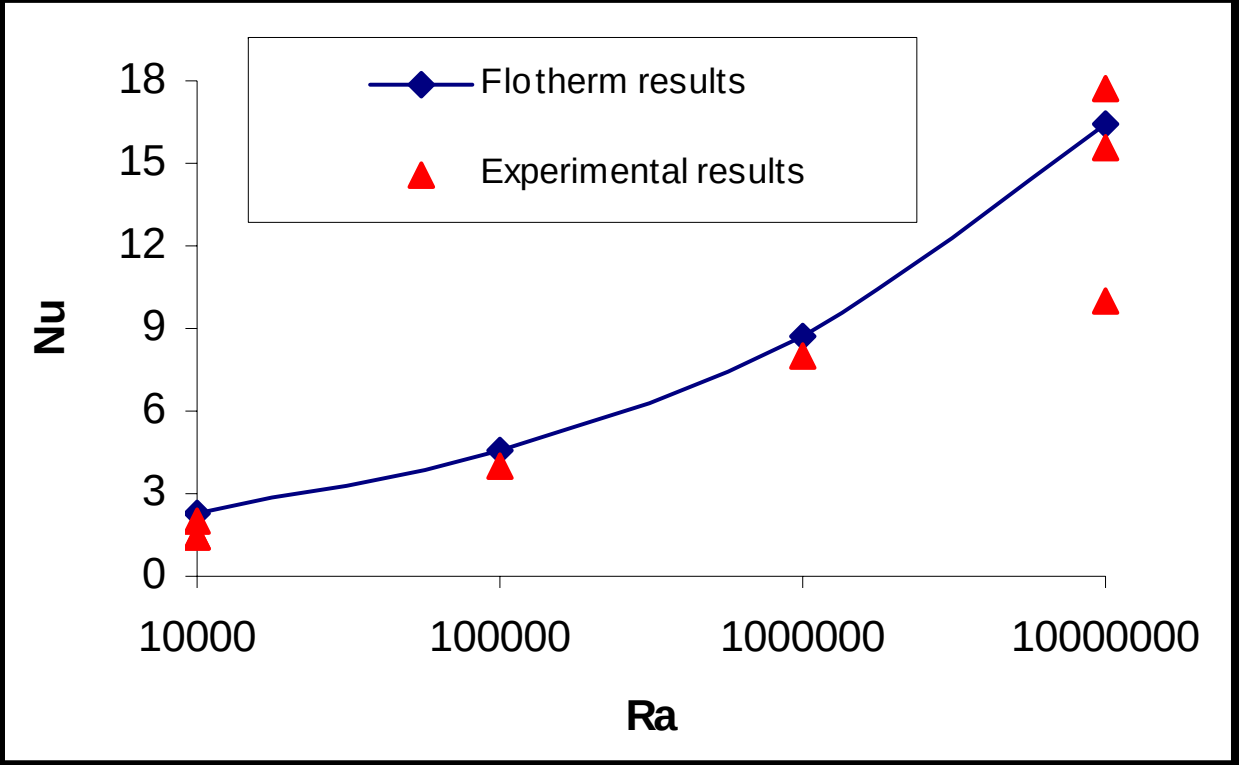
- Heat transfer by natural convection





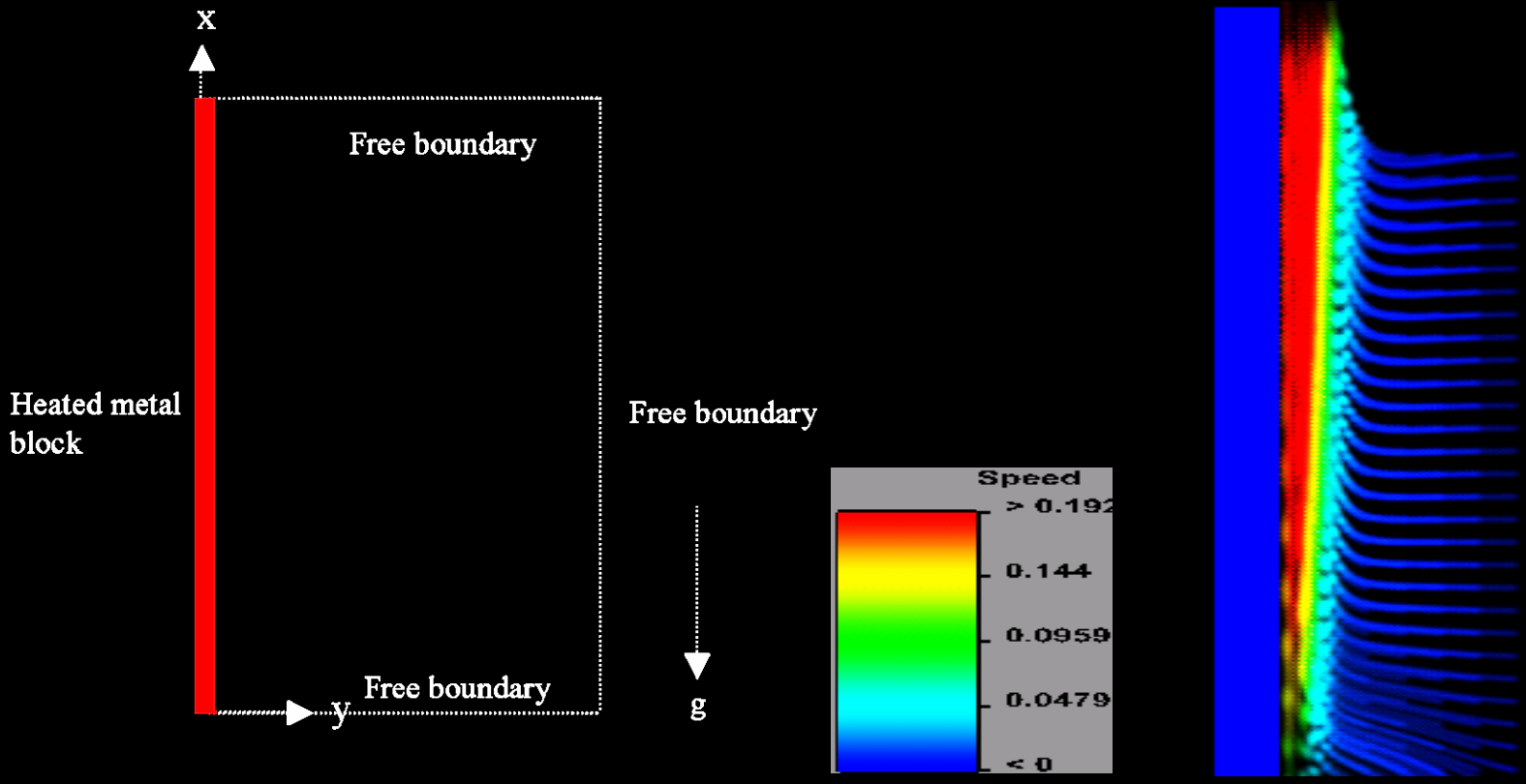
Closed Cavity

- Nusselt vs Rayleigh Number



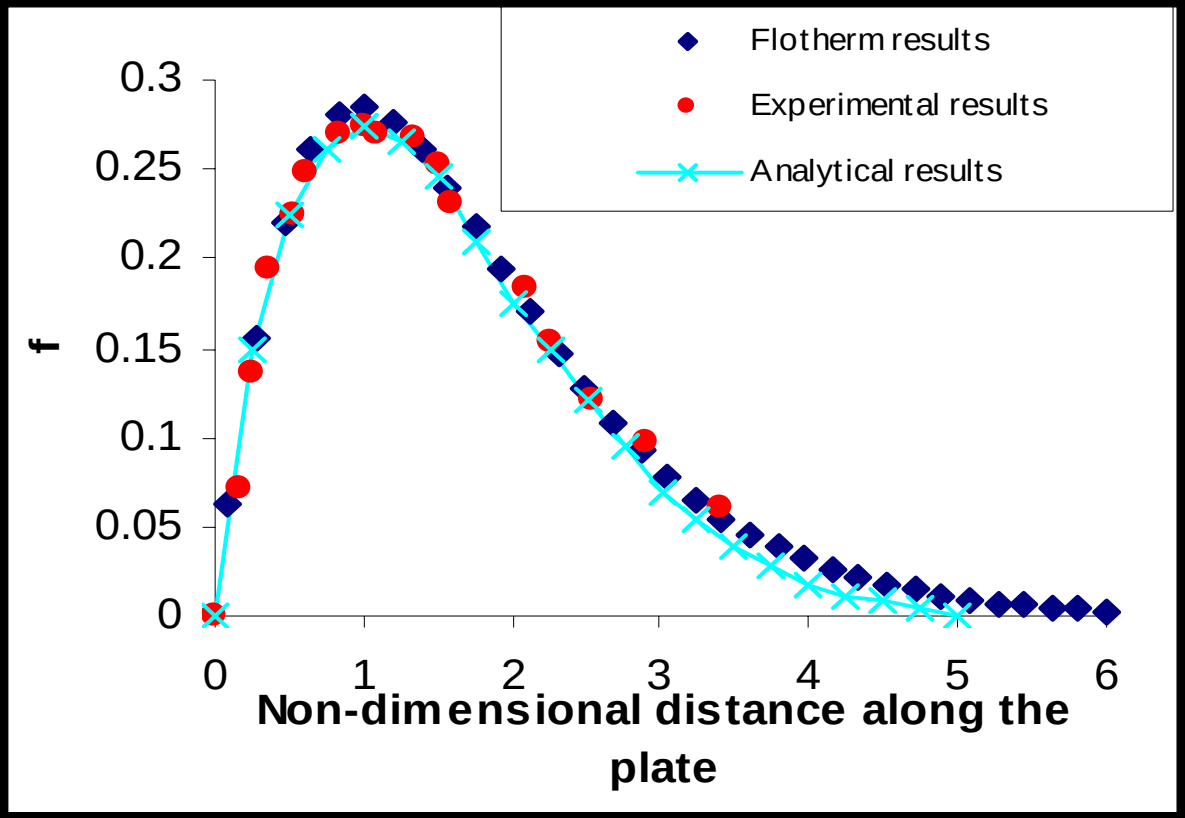
Vertical Plate

- Natural Convection



Vertical Plate

- Dimensionless velocity, f



Vertical Plate

- Dimensionless temperature