

Numerical investigation of the critical Re number value and the determination of the position of transition to turbulence inside a U-tube

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ABSTRACT

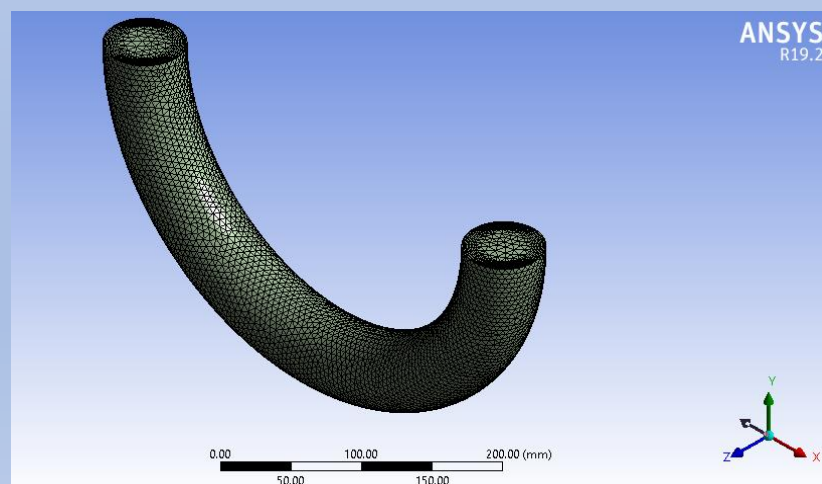
In the current diploma thesis, a numerical investigation was conducted for the transition from laminar to turbulent flow regime for a curved U-tube.

A methodology is proposed for the determination of the critical Re number, and how this value varies, based on the position inside the tube. It is studied how the curvature ratio γ , affects Re_{crit} value.

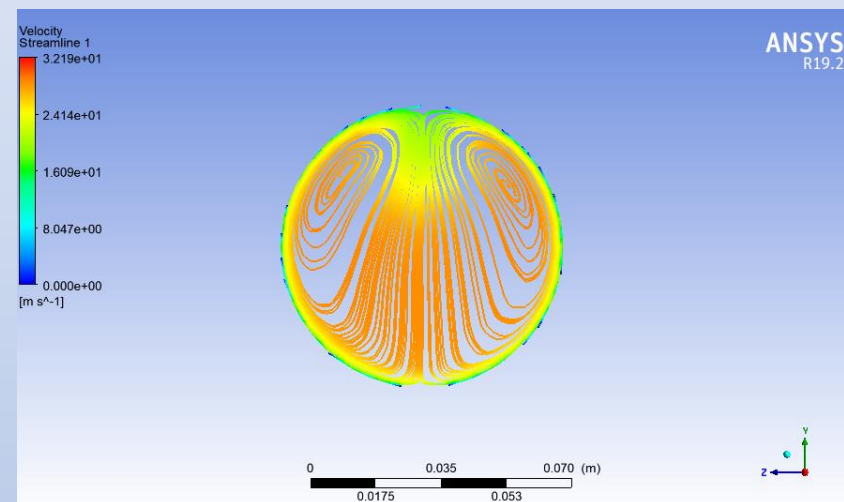
Three geometries are investigated for U-tube : A) $\gamma = 0.1$, B) $\gamma = 0.05$, C) $\gamma = 0.025$

For the modeling, the ANSYS-Fluent software is used.

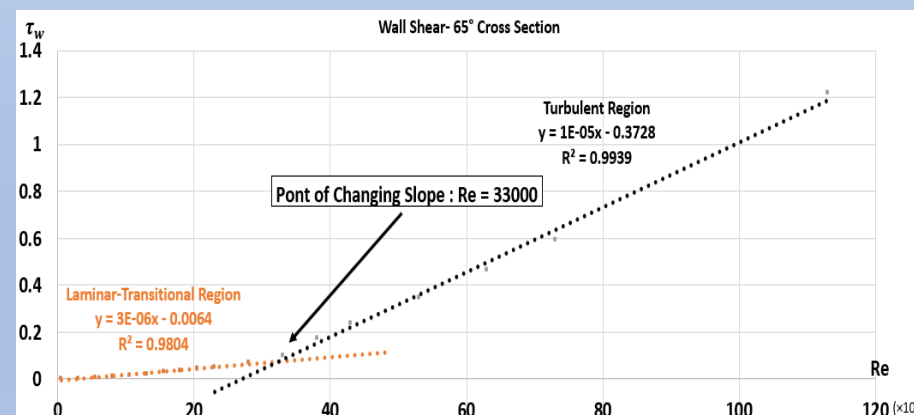
GEOMETRY



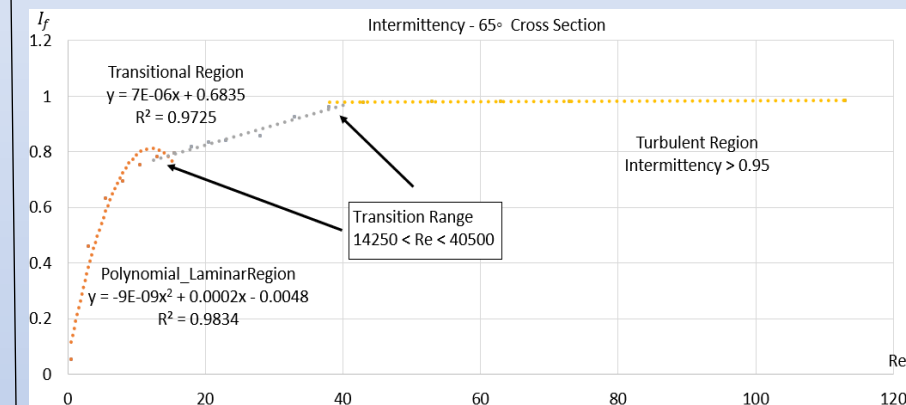
SECONDARY FLOW – DEAN CELLS



SLOPE CHANGE– TRANSITION TO TURBULENT FLOW



LAMINAR AND TURBULENT FLOW REGIME



CONCLUSIONS - RESULTS

- As the ratio of curvature γ increases Re_{crit} increases. As angle of cross section θ° , Re_{crit} increases
- The transition in a curved tube occurs more gradually than in a straight pipe, between a range of Re values $Re_{critLow}$ and $Re_{critHigh}$
- As γ increases the transition area becomes larger
- The transition to turbulent flow occurs earlier in the outer side of the tube, because faster particles are leaded there