

Test Case 3 - Fluids Labs

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Abstract

The present case concerns the development of the boundary layer produced by a uniform flow over a flat plate. The flow develops from a condition of uniform velocity U_∞ imposed at the inlet boundary, growing indefinitely without reaching a fully-developed state. Up to a distance x_{lam} from the leading edge such that $\text{Re}_x = U_\infty x_{\text{lam}} / \nu \approx 1 \times 10^5$, the boundary layer remains laminar; beyond a distance x_{turb} from the leading edge such that $\text{Re}_x = U_\infty x_{\text{turb}} / \nu \approx 3 \times 10^6$, the boundary layer is fully turbulent; in-between x_{lam} and x_{turb} , transitional boundary layer will occur. In this Laboratory, PHOENICS is used to simulate the development of the laminar boundary layer, whereas the analysis of the turbulent part will be shelved for further individual study. [1]

1 Introduction

The remainder of the report is organized as follows: Section 2 addresses the general procedure of simulation convergence verification and mesh suitability, whereas Section 3 compares the simulation results against the reference model.

2 Suitability of the CFD model

3 Comparison against the Blasius solution

References

- [1] Prof. G. V. Messa and Dr. G. Ferrarese. Test case 3: Development of boundary layer over a flat plate. Lab Guide, Fluid Labs, 2021.