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A new approach to low-cost open-typed subsonic compressible flow wind tunnel for academic purpose (Article)

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Abstract

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The most challenging task concerning wind tunnel description is, to ascertain the supporting mechanism at high-speed flows inside test section with least complexity and low-cost. This paper presents the design and development of a simple and cost effective test section for a subsonic compressible wind tunnel for educational purpose. The objective of this open-type wind tunnel was to demonstrate flow around model without any interference at highspeeds. In this work, that is study of flow analysis, a subsonic square nozzle was fabricated to achieve maximum velocity of 340 m/s. The test section is 25 mm x 25 mm x 70 mm and is externally attached with travers. It starts from length 25 mm to avoid dead zone and ends at 95 mm to avoid end effects, and on one of the surfaces pressure taps were provided for measuring pressure at different locations inside the wall of duct. The duct length was taken as 100 mm and the pressure taps were at the distance of 8 mm, 16 mm, 24 mm, 49 mm, 59 mm, 80 mm and 90 mm to measure wall pressure. They were connected to sensors through PVC tubes and further to DAQ using LabVIEW interface, and finally to the computer. In addition to this, the flow through the duct can be visualized using transparent glass to find the reattachment point for our recirculation bubble. A new concept of attaching models in a 3 D travers was found very easy for inserting it from behind in test section, and thereby interference and breaking of strings was eliminated. Calibration was done through pitot tube at the exit of test section in y and z direction. The nature of graph tells about the correctness of the designed wind tunnel test section. After calibration, we found that the exit velocity is constant for approximately 80 percent area. This area is the effective test section work area. © TJPRC Pvt. Ltd.

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