Abstract

There was a need for a technique to be able to enhance the flow properties by decreasing the velocity and increasing the skin friction , in adverse pressure gradient (APG), thus gives us an idea for new working . The present work used a technique of the effect of external acoustic excitation with two positions of loud speaker perpendicular and parallel to the flow direction , taking (150) Hz excitation frequency and (95) dB sound pressure level on a turbulent flow field of (APG), over a rough and smooth surface . It was conducted at a fully developed turbulent flow with a Renylods number based on a hydraulic diameter (8.3×10^4) and square cross section duct of (250 × 250) mm with length of (690) mm , produced in unsymmetric diffuser with range of angles (8^o , 11^o , 15^o) of (APG).

The experimental tests were carried out in a wind tunnel manufactured from Perspex with square cross section (250 ×250) mm and length (2400) mm, placed in the Fluid Laboratory of the Department of Mechanical Engineering–University of Technology. Preston tube was used to measurer the shear stress on the smooth and rough surface with fully rough (4.75) mm .

The results indicated that on the rough and smooth surface , the external parallel acoustic excitation is more convenient for skin friction than the external perpendicular acoustic excitation for diffusers with an angles (8°, 11^o,15^o) , and the boundary layer thickness increases with the divergent section and rough surface .

Also ,the obtained results showed that the performance and the other flow characteristics of diffusers depend on the angle of diffuser , external acoustic excitation position, and the surface roughness which enhanced the production of

turbulence when compared with the smooth-surface data, so both wall roughness and APG reduce the mean velocity close to the wall.

Additionally, the results exhibited an increase in the skin friction c_f due to the roughness and the external acoustic excitation. From the resuls, it was noted that the larger value of skin friction is (about 59.2% , 62.8% ,73.9%) for angles of diffuser (8°, 11°,15°, respectively), and less value of mean velocity about (5.3% , 5.9% , 8.14%) for angles of diffuser (8°, 11°,15°,respectively), when using the parallel acoustic excitation location.

The rough surface with the external parallel acoustic excitation effect are regarded as the key parameters to enhance the flow characteristics. This technique is able to decrease the velocity , increase the skin friction , enhance the flow properties and thus improve the flow structure.