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EFFECT OF WALL PROXIMITY IN FLUID FLOW AND HEAT TRANSFER FROM A SQUARE PRISM PLACED INSIDE A WIND TUNNEL

ABSTRACT

Experimental investigations in fluid flow and heat transfer have been carried out to study the effect of wall proximity due to flow separation around square prisms. Experiments have been carried out for the Reynolds number 4.9 * 10^4, blockage ratios are 0.1, 0.2, 0.3 and 0.4, different height-ratios, and various angles of attack. The static pressure distribution has been measured on all faces of the square prisms. The results have been presented in the form of pressure coefficient, drag coefficient for various height-ratios and blockage ratios. The pressure distribution shows positive values on the front face whereas on the rear face negative values of the pressure coefficient have been observed. The positive pressure coefficient for different height-ratios does not vary too much but the negative values of pressure coefficient are higher for all points on the surface as the bluff body approaches towards the upper wall of the wind tunnel. The drag coefficient decreases with the increase in angle of attack as the height-ratio decreases. The maximum value of drag coefficient has been observed at an angle of attack nearly 50° for square prism at all height-ratios. The heat transfer experiments have been carried out under constant heat flux condition. Heat transfer coefficients are determined from the measured wall temperature and ambient temperature, and presented in the form of Nusselt number. Both local and average Nusselt numbers have been presented for various height-ratios. The variation of local Nusselt number has been shown with non-dimensional distance for different angles of attack and blockage ratios. The variation of average Nusselt number has also been shown with different angles of attack for blockage ratios. The local as well as average Nusselt number decreases as the height-ratio decreases for all non-dimensional distance and angle of attack for square prisms. The average Nusselt number for square prisms of different blockage ratio varies with the angle of attack. But there is no definite angle of attack at different blockage ratio at which the value of average Nusselt number is either maximum or minimum.

KEYWORDS

flow separation, square prism, blockage ratio, height-ratio, angle of attack, pressure coefficient, drag coefficient, nusselt number

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