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A Study on Shock Formation over a Transonic Aerofoil

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Abstract : Aerofoil is a primary element to be designed during the initial phase of creating any new aircraft. It is the component that forms the cross-section of the wing. The wing is used to produce lift force that balances the weight which is acting downwards. The lift force is created due to pressure difference over the top and bottom surface which is caused due to velocity variation. At sub-sonic velocities, for a real fluid, we obtain a smooth flow of air over both the surfaces. In this era of high speed travel, commercial aircraft that can travel faster than speed of sound barrier is required. However transonic velocities cause the formation of shock waves which can cause flow separation over the top and bottom surfaces. In the transonic range, shock waves move across the top and bottom surfaces of the aerofoil, until both the shock waves merge into a single shock wave that is formed near the leading edge of theaerofoil. In this paper, a transonic aerofoil is designed and its aerodynamic properties at different velocities in the Transonic range (M = 0.8; 0.9; 1; 1.1; 1.2) are studied with the help of CFD. The Pressure and Velocity distributions over the top and bottom surfaces of aerofoil are studied and the variations of shock patterns, at different velocities, are analyzed. The analysis can be used to determine the effect of drag divergence on the lift created by the aerofoil.

Keywords : transonic aerofoil, cfd, drag divergence, shock formation, viscous flow
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