ABSTRACT

An attempt has been made to develop numerical methods for solving various problems associated with unsteady flow past three-dimensional configurations undergoing different modes of oscillation. The study in this thesis covers the speed range from low subsonic to transonic regime. A very simple and economical low order potential based panel method, which is capable of providing very accurate steady flow results, has been adapted and extended to investigate the unsteady flow behavior of wings and wing-body combinations. The unsteady transonic flow calculations are performed, using the modified transonic small disturbance (TSD) equation, based on the non-linear time integration and time-linearization approaches. The following problems have been studied in the present work:

(i) simple harmonic motion of wings and wing-body combinations in inviscid incompressible flow,

(ii) wings and wing-body combinations in unsteady motion in inviscid incompressible flow,

(iii) simple harmonic motion of wings and wing-body combinations in inviscid compressible flow, and

(iV) unsteady transonic flow calculation for wings using the transonic small disturbance equation.

Computer codes in Fortran 77 have been developed for all these cases. To asses the accuracy of the methods the computed results have been compared with the available theoretical and experimental values.

KEY WORDS: Subsonic and transonic speeds, oscillatory, frequency parameter, pitching, heaving, bending, freestream, Kutta condition, approximate factorizaion, SLOR, NLTI-TSD, LTD-TSD, LTI-TSD.