

PROJECT

ME 419

Professor S.K. Aggarwal

Due:

(This project is worth 15% of the grade)

Write a computer program (using FORTRAN or another language) to analyze compressible flow in a variable-area duct.

(a) The program should be able to predict the variation of flow properties such as pressure, Mach number, velocity etc. as function of x in a converging-diverging nozzle for a range of back pressures (p_b/p_0) including (i) isentropic subsonic and supersonic flow (ii) flow with normal shock which is located either inside the nozzle or at the nozzle exit, (iii) flow with oblique shock at the nozzle exit, and (iv) underexpanded flow with expansion fan at the exit. For case (ii), the program should also give the shock location, while for case (iii), it should give the oblique shock angle.

(ii) The program should be sufficiently interactive so that it makes predictions for a given p_b/p_0 , and tells the user whether the flow is isentropic, or there is a normal shock (and where is it located) or an oblique shock in the system etc.

Notes:

1. The program should have subroutines that generate isentropic flow tables for given γ , as well as normal shock table, oblique shock charts, and Prandtl-Meyer table.
2. The program will need the duct area as a function of x , $A(x)$, as input. You can prescribe $A(x)$ any way you like.