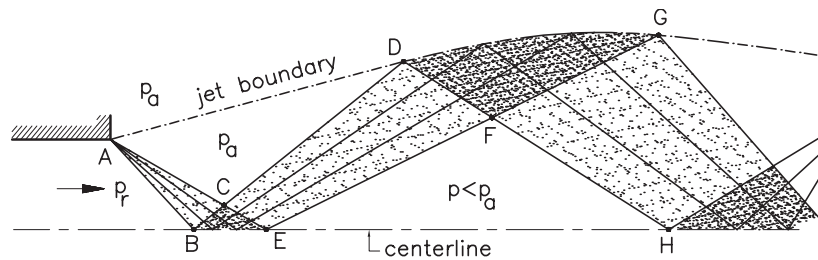


Gasdynamics task 2

2024/2025

Consider the underexpanded jet that is discussed in Chapter 7 of the Gasdynamics Course Notes.



Apply the M.O.C. to find the development of the jet flow downstream of the nozzle. The flow in the exit of the nozzle has a Mach number $M_e = 2$. The exit flow is parallel and underexpanded, which means that the pressure in the exit (p_e) is higher than the pressure of the ambient (p_a). Assume $p_e = 2p_a$.

- Write a computer program based on the M.O.C. to determine the flow field in the jet. Try to write your code for an arbitrary number of characteristics (e.g. determined by the user when the code is executed).
- Describe your approach and include the essential parts of the source code (no need to include all plotting routines) in your report. You may stop the calculations when a shock appears at the location where characteristics of the same family intersect (downstream of point H in the figure above).
- Take enough characteristics (>10) inside the centered expansion in order to see the details (converging/diverging characteristics, shock formation, etc) of the flow field.
- Produce a detailed picture of the characteristic pattern, including the shape of the jet boundary. *Comment/discuss* the pattern of characteristics and jet boundary shape.
- Show and discuss the Mach distribution in the jet area.
- Show and discuss the static pressure distribution in the jet area
- *Comment/discuss* on the accuracy of your computations, does it matter how many characteristics you use in the computation?

Extra question (in case you have time left)

- How does the location where the shock appears vary when the exit Mach number or exit pressure is changed? You can answer this question either quantitatively (by performing additional simulations) or qualitatively (by looking at the slope of the characteristics).