

AS 203 Gas Dynamics Practice Problems -4

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1. A 2D moc interior point is to be calculated from two upstream points at (x,y) given by (1,1) and (1,1.1). The respective θ values are 5° and 7° . The mach numbers are 2 and 2.1 respectively. Find the x, y, M and θ at the new point. [1.0915, 1.0641, 2.0866, 7.3587]
2. Find the axis point from the lower point in the previous problem. What if the Mach number was 1.1 instead of 2? [3.1445, 0, 2.1864, 0; 1.5685, 0, 1.3061, 0]
3. There are 3 point in the flow whose properties are given as follows: A=[1 0.1 2 5], B=[1 0.2 2.1 7], and C=[1 0.3 2.2 9], where the numbers correspond to [x, y, M, $\theta(\text{deg})$]. March forward the MOC grid to find all the possible new points. You could go for axis (y=0) points also, but there is no information about the upper bound for the flow. Is the flow field accelerating or decelerating?
{P1 = [1.2145, 0, 2.1864, 0], P2 = [1.0915, 0.1641, 2.0866, 7.3587], P3 = [1.0964, 0.2686, 2.1878, 9.3177], P4 = [1.3430, 0.0661, 2.2784, 2.3587], P5 = [1.1927, 0.2376, 2.1740, 9.6764], P6 = [1.4938, 0, 2.3733, 0], P7 = [1.4866, 0.1437, 2.3716, 4.6764], P8 = [1.6630, 0.0786, 2.4698, 2.3177], P9 = [1.8618, 0, 2.5698, 0]}
4. There is a wall running through point C of problem 3 and flow is parallel to it. If the wall is a straight line wall, find the next wall point. [1.1766, 0.3280, 2.1756, 9.0000]
5. If C is a wall point as described in problem 4, and we want to create an isentropic nozzle wall, find the next wall point. [1.1774, 0.3286, 2.1878, 9.3177]
6. Lets say that we have a flow of M=3.4, $\theta=0$, with a 40° oblique shock at (1,0.3). Use the interior point given by [1.16, 0.35, 2.1, 20] to find the next shock point. [1.1802, 0.3728, 2.1540, 21.4332]