Computational Aerodynamics Questions & Answers

Question by Student 201527110

Professor, in my opinion, we have to consider about the change of properties when flow pass through the shock for the supersonic flow example you explained today, but there was any no mention about shocks. Could you explain why we can ignore the changing of properties by shock?

Hmm, I didn't mention about the shock today and there is no reason to at this stage.. But I'll give you 0.5 point bonus for the effort.

Question by Student 201127151

Professor, I have a question about the flux jacobian A. You explained that the scalar equation for a wave is

$$\frac{\partial u}{\partial t} + a\frac{\partial u}{\partial x} = 0$$

I understood that 'a' is a wave speed. And then you taught that the Euler equations for a wave in 1D is

$$\frac{\partial U}{\partial t} + A\frac{\partial U}{\partial x} = 0$$

Here, 'A' is the flux jacobian and I understood it mathematically. I think that it means the notion of a wave speed like 'a'. But I can't clearly comprehend the meaning of 'A'. What does it means exactly?

Well the mathematical definition of A is the flux jacobian, i.e.

$$A \equiv \frac{\partial F}{\partial U}$$

This was mentioned in class. 0.5 point bonus.

Question by Student 201127151

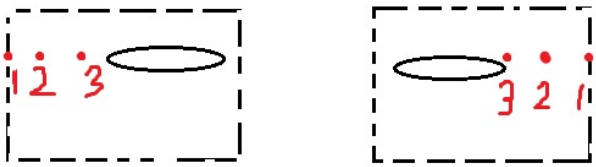
Professor, I am so curious about the boundary condition of the supersonic inflow. At question #1 - (a) of assignment #6, I find that the boundary condition is the supersonic inflow. So I think that all properties at node 1 are extrapolated externally as follows :

$$T_1^{n+1} = T_\infty,\ P_1^{n+1} = P_\infty,\ M_1^{n+1} = M_\infty$$

If so, I think u_1^{n+1} and v_1^{n+1} are also regarded as u_∞ and v_∞ respectively. Am I solving it correctly?

Yes, that is correct. But you need to demonstrate why this is through the perpendicular Mach number and wave speeds. 2 points bonus.

Question by Student 201227141



Professor, inflow at BC when calculate update node1, we used M_1^n to estimate subsonic or supersonic. But outflow at BC when calculate update node1, we used M_2^n to estimate subsonic or supersonic. I am confused why these differences exist.

Very good question. I made a mistake in class: always use M_2^n to estimate whether the BC is subsonic of supersonic. Please change your notes accordingly. 2 points bonus boost.

Question by Student 201427564

Professor, in assignment6, you asked to calcualte properties using 2nd degree polynomial. Can we calculate mach number using 2nd degree polynomial? Or 2nd degree polynomial just for temperature and pressure?

You should use 2nd degree polynomials for all properties that are used to rebuild the U vector at the boundary node (i.e., u, v, T, P). 1 point bonus boost.

Question by Student 201227141

Professor, when subsonic inflow we used the equation like $T_0 = T(1 + 0.5(r-1)M^2)$. But we didn't use this at outflow. So I think this difference come from position of wing. I think there is no stagnation point at outflow. Am i right?

Hm no, there is always a stagnation point even if the flow does not come to a stop anywhere along the streamline. The stagnation point is imaginary. 1 point bonus.