Fundamentals of Fluid Mechanics B Questions and Answers

Question by AME536A Student

Dr.Parent. I am waiting for your feedback for the prob #3 in the assignment 3. If you don` t mind, could you please give me your feedback?

Plan for my comments to be given within 1 week of the submission date or so.

Question by AME536A Student

I would like to make sure again that mid-term will be performed in at 11-12:15 on March 23,on next Tuesday.

Yes, this is correct. It will be proctored using zoom. Bring a pencil or a pen with black ink and some sheets of paper and a cheap calculator.

Question by AME536B Student

For journey bearing problems we can unroll the problem to solve in cartesian coordinates rather than polar coordinates if the difference in the inner and outer diameter is small.
In an example from class, we had $D_i = 10cm$ and $D_o = 11cm$ and were able to use the cartesian approximation. If we define the ratio between the diameters as follows:
$R = \frac{D_i}{D_o}$
what is the minimum value of R that allows us to use the cartesian coordinates instead of polar coordinates?

For $R > 0.9$ you can unroll the problem in xy coordinates. Then, the error will be less than $\sim 10\%$ on the shear stresses.

Question by AME536B Student

In the Tables, Section 1.6, the streamfunction for Stokes flow is given as:

$$\psi = \sin^2\theta \left[\frac{q_\infty R^3}{4r} - \underbrace{\frac{3q_\infty R^2}{4}}_{(1)} + \frac{q_\infty}{2} r^2 \right]$$

Shouldn't the (1) term be

$$-\frac{3q_\infty R}{4}r$$

it appears in that form from other sources (eqn 21.8.10 in Panton).

Correct. You can verify that this is true when deriving ψ over a sphere in the next assignment. This has been corrected in the tables. See updated tables.

Question by AME536B Student

Dr. Parent. I'm unsure how to start with Problem 2 in Assignment 5. Is it right to proceed with using spherical coordinates or would some other approach be better? Also, if we must use spherical coordinates, I'm unsure how to scale θ, $\sin\theta$ etc. Could you please provide some hint with approaching this question?
Thank you.

For part (a), rewrite the terms in the momentum equation using order of magnitude approximations in the vicinity of the sphere. It's not needed to use spherical coordinates. For part (b), do the same but far away from the sphere. The terms will not simplify to the same expressions as in (a).

Question by AME536B Student

Dr. Parent, for Assignment 5, Question 1 c), I realized that it is not enough to find $\tau_{r\theta}$ in order to find drag force, because my final answer does not match the tables. I was wondering how to proceed after finding $\tau_{r\theta}$?

This needs to be integrated over the surface of the sphere.