FLORIDA INSTITUTE OF TECHNOLOGY
AEROSPACE, PHYSICS, AND SPACE SCIENCES

AEE 5150-E1: Computational Fluid Dynamics
Fall 2021

Coding Project 4

Due November 30, 2021

For this assignment, you are to generate a computational mesh around an airfoil within a circular domain. The shape of the airfoil's surface is defined by:

$$\pm y = \frac{t}{0.2}\left(0.2969x^{1/2} - 0.126x - 0.3516x^2 + 0.2843x^3 - 0.1015x^4\right)$$

where t is the maximum thickness as a percentage of the chord, and x is measured from the leading edge. Because of round-off error, you should ensure that the y-coordinate at the trailing edge is identically zero. For this problem, let $t = 0.2$, and the chord (i.e. length of the airfoil) be equal to 1.0. The domain is to be circular and three chord-lengths in diameter, as measured from the midpoint of the airfoil chord.

Your mesh dimensions (*IM* x *JM*) is to be 35 x 21, with the i in the tangential direction and j in the radial direction. Start by creating your airfoil shape with nodes equally spaced in the x-direction along the chord, and the y-coordinate given by the equation above. On the outer edge of the domain, the nodes are to be equi-angularly spaced. The nodes on the airfoil surface and the outer domain edge will be fixed, and constitute two of the boundary conditions.

Create an initial grid with (approximately) equally-spaced nodes in the radial direction. Once you've created the nodes on the airfoil surface, shift the origin to the mid-chord position to create the remainder of the mesh. The exact look of this initial grid may vary from person to person so long as it conforms to the stated guidelines. Remember that a branch-cut will be made at $i = 1$ and $i = IM$, even though the actual nodes will be coincident.

Using the techniques discussed in class and §9.7.2 in the text, solve the elliptic equation using either the Line Gauss-Seidel or LSOR algorithms that converge when the maximum error is less than 0.01.

To complete this assignment, submit your code, plots of both your initial and final grids. Everything must be submitted in hardcopy, and the code must also be submitted on Canvas.