



Academic Year:	2024/2025	First Term:	Fall 2024
Department:	Aerospace	Course Code:	AER 4110
Date:	November 2024	Course Title:	Computational Aerodynamics
Due date:	30 Nov 2024	Course Project:	CFD



Project Problem Statement

The governing equation for the two-dimensional potential incompressible flow over the NACA airfoil section can be written using Laplace's equation as " $\nabla^2 \Psi = 0$ " where " ψ " is the stream function.

- a) The table below gives the NACA five-digit airfoil designation with the corresponding angle of attack (A.O.A.) for each student.
- b) Construct a suitable boundary fitted grid (η_1, η_2) using (H-grid) or (O-grid) or (C-grid).
- c) Write the governing equation in the proposed body fitted grid (η_1, η_2).
- d) Choose the numerical method used to solve the governing equation (PSOR) or (LSOR).
- e) Choose an appropriate initial value for the stream function ψ for all points in the grid.
- f) Obtain the numerical solution until convergence.
- g) Show the convergence log results ("RMS" of error with iteration number).
- h) Show the iso-velocity and iso-pressure lines in the entire domain.
- i) Show the velocity and pressure distributions on the upper and lower surfaces of the airfoil and compare these results with the experimental results or other 2-D computational method.
- j) Determine the lift, drag, and moment coefficients $C_l, C_d, C_m(0.25c)$, the latter relative to the quarter-chord point, for the airfoil.

Sec.	B.N.	NACA	A.O.A.
1	1	23012	5
1	2	23012	6
1	3	23012	7
1	4	23012	8
1	5	23012	9
1	6	23014	5
1	7	23014	6
1	8	23014	7
1	9	23014	8
1	10	23014	9
1	11	23016	5
1	12	23016	6
1	13	23016	7
1	14	23016	8
1	15	23016	9

Sec.	B.N.	NACA	A.O.A.
2	1	23013	5
2	2	23013	6
2	3	23013	7
2	4	23013	8
2	5	23013	9
2	6	23015	5
2	7	23015	6
2	8	23015	7
2	9	23015	8
2	10	23015	9
2	11	23017	5
2	12	23017	6
2	13	23017	7
2	14	23017	8
2	15	23017	9

1	16	23018	5
1	17	23018	6
1	18	23018	7
1	19	23018	8
1	20	23018	9
1	21	23020	5
1	22	23020	6
1	23	23020	7
1	24	23020	8
1	25	23020	9
1	26	23022	5
1	27	23022	6
1	28	23022	7
1	29	23022	8
1	30	23022	9
1	31	23024	5
1	32	23024	6
1	33	23024	7
1	34	23024	8
1	35	23024	9
1	36	23026	5
1	37	23026	6
1	38	23026	7
1	39	23026	8
1	40	23026	9
1	41	23028	5
1	42	23028	6
1	43	23028	7

2	16	23019	5
2	17	23019	6
2	18	23019	7
2	19	23019	8
2	20	23019	9
2	21	23021	5
2	22	23021	6
2	23	23021	7
2	24	23021	8
2	25	23021	9
2	26	23023	5
2	27	23023	6
2	28	23023	7
2	29	23023	8
2	30	23023	9
2	31	23025	5
2	32	23025	6
2	33	23025	7
2	34	23025	8
2	35	23025	9
2	36	23027	5
2	37	23027	6
2	38	23027	7
2	39	23027	8
2	40	23027	9
2	41	23029	5
2	42	23029	6
2	43	23029	7