DÉPARTEMENT DE GÉNIE MÉCANIQUE
POLYTECHNIQUE MONTRÉAL

MEC8211 - VÉRIF. et VALID. en MODÉLISATION NUMÉRIQUE - DAVID VIDAL

PROJECT DESCRIPTION

S. Paquette-Greenbaum, R. Zachariah, & K. A. N. Lippert

In this project, CFD code(s) which model the Reynolds-averaged Navier-Stokes equations will be the subject of a verification and validation study across 2-dimensional static and dynamic aerodynamic references cases. Open-source CFD software(s) such as OpenFOAM and SU2, and potentially in-house CFD codes will be the target of the V&V study, offering a comprehensive examination across different platforms. The modelled equations will be briefly analyzed, along with the numerical methods through which they are implemented. The reference cases in question will focus on 2D flows around airfoils in near standard atmospheric conditions. The static reference case [1] will be composed of flows around airfoils at constant angles of attack between 0 degrees and stall, whereas the dynamic reference case [2] will showcase the physics of flow around an airfoil in rigid harmonic motion. The dynamic reference case will be used in the context of code verification, where an order of convergence study will be conducted. The static reference case will be used more broadly in the V&V procedure, hence, the quality of the associated experimental data will be of critical importance. The static reference case will be the basis for solution verification, uncertainty propagation, model validation, and predictive accuracy assessment. Time permitting, the project may also include comparative analyses across different CFD codes to identify strengths and weaknesses in various implementations.

References

[1] C. L. Ladson, "Effects of independent variation of mach and reynolds numbers on the low-speed aerodynamic characteristics of the naca 0012 airfoil section," *NASA Technical Memorandum*, no. 4074, 1988.

[2] T. Lee and P. Gerontakos, "Investigation of flow over an oscillating airfoil," *Journal of Fluid Mechanics*, vol. 512, pp. 313 – 341, 2004. [Online]. Available: http://dx.doi.org/10.1017/S0022112004009851

Table 1: Pondération choisie par l'équipe 4

Élément	**Pondérations min-max (%)**	**Pondération choisie**
Modèle mathématique (1 page)	0 ou [5-20]	5
Discrétisation (1 pages)	0 ou [5-20]	5
Qualité logicielle	0 ou [10-20]	0
Vérification du code (5 pages)	0 ou [15-30]	25
Vérification de solution (3 pages)	0 ou [15-35]	15
Propagation des incertitudes (4 pages)	0 ou [15-35]	20
Validation (4 pages)	0 ou [15-35]	20
Prédiction (2 pages)	0 ou [10-20]	10
Total : entre 20-30 pages PowerPoint.		**100**

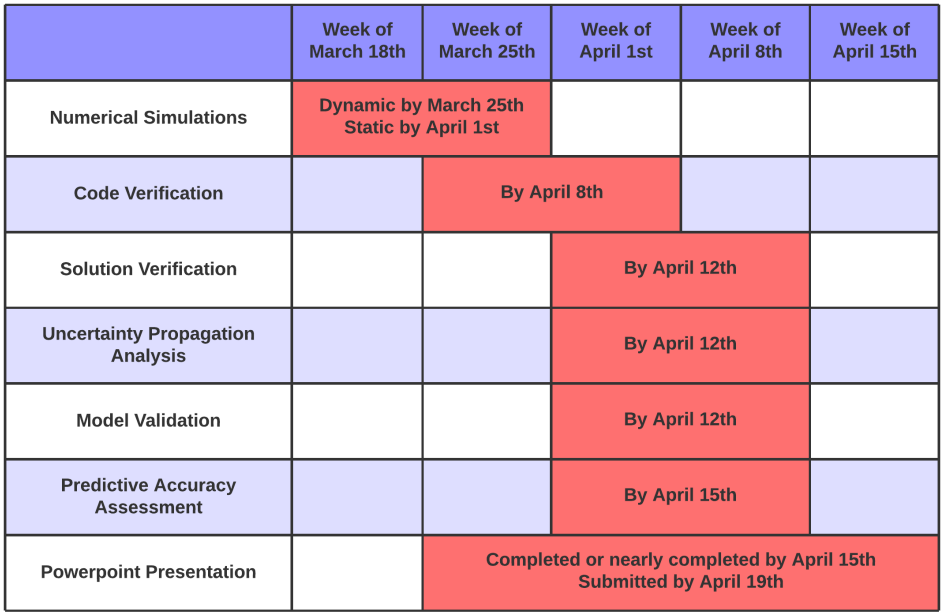

Figure 1: Project Gantt Chart