AER 1318H: Introduction and Course Outline 2020

Professor D.W. Zingg
(416-667-7709, dwz@oddjob.utias.utoronto.ca, http://goldfinger.utias.utoronto.ca/dwz)

Textbook

Fundamental Algorithms in Computational Fluid Dynamics, T.H. Pulliam and D.W. Zingg, Springer, 2014 (available at the textbook store and online)

Schedule and Mark Breakdown

1. Jan. 15	Lecture	
2. Jan. 22	Lecture	
3. Jan. 29	Lecture	Assignment 1 due (worth 5%)
4. Feb. 19	Lecture	Assignment 2 due (worth 35%)
5. March 4	Lecture	
6. March 18	Lecture	Assignment 3 due (worth 25%)
7. March 25	Lecture	
8. April 1	Meeting	Assignment 4 due (worth 15%)
9. April 15	Oral Examination (worth 20%)	

Course Outline

1. An Implicit Finite-Difference Algorithm (ARC2D)

1.1 Generalized curvilinear coordinate transformation
1.2 Spatial differencing, including summation-by-parts methods
1.3 Implicit time marching and approximate factorization
1.4 Convergence acceleration techniques
1.5 Boundary conditions

2. An Explicit Finite-Volume Algorithm with Multigrid (FLOMG)

2.1 Spatial discretization
2.2 Multi-stage time-marching method
2.3 Implicit residual smoothing
2.4 Multigrid

3. Introduction to High-Resolution Upwind Schemes

3.1 Godunov's method
3.2 Roe's approximate Riemann solver
3.3 General formulation of higher-order upwind schemes
3.4 The definition of high-resolution schemes
3.5 Second-order TVD semi-discrete schemes with limiters