MAE-210B Advanced Fluid Dynamics

Course Research Project Assignment – Winter 2018

- Form nine 2-person teams (including Logan)

- Each team choose a canonical ("building-block") flow from provided menu (below)

- Research and report:
  - real-world applications for your canonical flow
  - driving physical phenomena
  - historical study (literature review)
  - experimental methods and results (including uncertainties and their sources)
  - computational methods and results (including uncertainties and their sources)
  - turbulence modeling aspects,
  - summary of the current state of the knowledge
  - remaining research challenges for this canonical flow.

- Product Part A: journal article
  - 15 pg minimum
  - Co-authored by team members (order of authorship in list doesn't matter)
  - use AIAA Journal format: http://www.aiaa.org/journalauthors/
  - LaTex preferable, but no penalty for using Word – both have templates on AIAA website
  - Due at presentation via email to Prof. Robinson

- Product Part B: presentation to the class
  - 15 minutes + 5min Q&A
  - Both team members must present – you choose the format
  - Mon 3/12 4:10-6pm 5 Team Presentations
  - Wed 3/14 4:10-6pm 4 Team Presentations

- Course deliverable is a book of N summary reports about canonical turbulent flows.

Turbulent "Building-Block" Flows

From 1981 Stanford Conference on Complex Turbulent Flows

Group IIa -- Flow Category - Incompressible

0110	Corner flow (secondary flow of the second kind) .	F.B. Gessner
0130	Entry zone of round tube	J.B. Jones
0140	Diffuser flows (unseparated)	R. Simpson
0150	Two-dimensional channel flow with periodic perturbations	M. Acharya
0210	Effect of free-stream turbulence on boundary layers	P. Bradshaw
0230	Boundary-layer flows with streamwise curvature .	T.W. Simon/S. Honami
0240	Turbulent boundary layers with suction or blowing	L.C. Squire
0250	Three-dimensional turbulent boundary layers	D.A. Humphreys/ B. van den Berg
0260	Turbulent wall jet	B.E. Launder/W. Rodi
0280	Relaminarizing flows	K.R. Sreenivasan
0290	Laminar-turbulent transition	E. Reshotko
0310	Planar mixing layer	S. Birch
0330	Free shear layer with streamwise curvature . . .	P. Bradshaw
0340	Flows with swirl	A.P. Morse
0350	Ship wakes	V.C. Patel
0360	Wakes of round bodies	V.C. Patel
0370	Homogeneous turbulent flows	J.H. Ferziger
0380	Wakes of two-dimensional bodies	V.C. Patel
0390	Axisymmetric boundary layer with strong streamwise and transverse curvature	V.C. Patel
0410	Evaluation of bluff-body, near-wake flows	B. Cantwell
0420	Backward-facing step flow	J.K. Eaton/J.P. Johnston
0430	Diffuser flow (separated)	R. Simpson
0440	Two-dimensional stalled airfoil	A.J. Wadcock
0470	Flow over the trailing edge of blades and airfoils	P. Drescher
0510	Turbulent secondary flows of the first kind . . .	R.B. Dean
0610	Attached boundary layers - ('68 Conference) . . .	D.E. Coles

Group IIb -- Flow Category - Compressible

8100	Supersonic flow over a flat plate (insulated wall)	M.W. Rubesin/ C.C. Horstman
8200	Supersonic flow over a flat plate (cooled wall)	MWR/CCH
8300	Turbulent boundary layers with suction or blowing at supersonic speeds	L.C. Squire
8310	Variation in C_f/C_{fo} for blowing/suction with Mach Number	L.C. Squire
8400	Boundary layers in an adverse pressure gradient in an axisymmetric internal flow	MWR/CCH
8410	Boundary layers in an adverse pressure gradient in 2-dimensional flow	MWR/CCH
8500	Compressibility effects on free shear layers	P. Bradshaw
8600	Impinged normal shock wave-boundary layer interaction at transonic speeds	MWR/CCH
8610	Transonic flow over a bump	MWR/CCH
8620	Transonic airfoils	R.E. Melnik
8630	Compressible flow over deflected surfaces	MWR/CCH
8640	Compressible flow over compression corner with reattaching planar shear layer	MWR/CCH
8650	Axisymmetric shock impingement (supersonic)	MWR/CCH
8660	Three-dimensional shock impingement (supersonic).	MWR/CCH
8670	Pointed axisymmetric bodies at angle of attack (supersonic)	D. Peake (D.J. Cockrell)
8680	Axisymmetric near wake (supersonic)	A. Favre
8690	Nonlifting, transonic airfoil with shock separation	MWR/CCH
9000	Flows with buoyancy forces	J.C. Wyngard

Group III -- Some Flows Warranting Further Study

1. Full details of several blunt bodies including wakes: (buildings, bumps, ...)
2. Radial wall jet flows
3. Wall jets impinging at angles to surface
4. Unsteady mean flows (report presented by L. Carr)
5. "Momentum-less" wakes
6. Jets in cross and counter flow
7. Two-dimensional separated flows (airfoil flaps)
8. "Low" Reynolds number boundary layers
9. Rough wall cases
10. Airfoil cases other than transonic