

**MAE 210C – FLUID MECHANICS III**  
SPRING 2017

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**Instructor:** Prof. Antonio L. Sánchez  
Email: als@ucsd.edu  
Office: EBUII 554  
Ph: (858) 822 3790

**Lectures:** Monday, Wednesday, Friday 9:00-9:50am

**Office Hours:** Monday 10:00am-11:00am, Wednesday 10:00am-11:00pm, EBUII 554

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**Text Book:** *Introduction to Hydrodynamic Stability*  
P. G. Drazin, Cambridge University Press (2002)

**Grading:** 3-4 assignments (80%) + Final project (20%)

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**Motivation:**

- “Yet not every solution of the equations of motion, even if it is exact, can actually occur in Nature. The flows that occur in Nature must not only obey the equations of fluid dynamics, but also be stable” (Landau & Lifshitz, 1959)

**Topics** (with reference to relevant sections in Drazin):

1. Introduction to hydrodynamic stability (§1 & §2)
2. Kelvin-Helmholtz and Rayleigh-Taylor instabilities (§3)
3. Capillary instability of a jet (§4)
4. Rayleigh-Bénard convection (§6)
5. Centrifugal instabilities (§7)
6. Inviscid instability of parallel flows (§8.1–8.4)
7. Viscous instability of parallel flows (§8.5–8.10)
8. Growth of disturbances in space and time (§5.1)
9. Transient growth and optimal perturbations
10. Weakly nonlinear theory (§5.2)
11. The energy method (§5.3)

**ADDITIONAL BIBLIOGRAPHY:**

- P.G. Drazin, W.H. Reid *Hydrodynamic Stability* Cambridge University Press (1981)
- F. Charru, *Hydrodynamic Instabilities* Cambridge University Press (2011)
- P. J. Schmid, D.S. Henningson, *Stability and Transition in Shear Flows* Springer (2001)
- W.O. Criminale, T.L. Jackson, R.D. Joslin, *Theory and Computation in Hydrodynamic Stability* Cambridge University Press (2003)
- S. Chandrasekhar, *Hydrodynamic and Hydromagnetic Stability*. Dover Publications (1981)
- D.J. Tritton, *Physical Fluid Dynamics*. Cambridge University Press (1990).
- M. Van Dyke, *An Album of Fluid Motion* Parabolic Press (1982).
- F.S. Sherman, *Viscous Flow* McGraw Gill (1990).
- D.J. Acheson, *Elementary Fluid Dynamics* Oxford University Press (1990).