Preliminaries

Instructor

My names is Stefan LLEWELLYN SMITH. My e-mail address is sgls@ucsd.edu. My e-mail address is sgls@ucsd.edu, but if you have a question, talk to me before or after class, or come to office hours.

Schedule

MWF 11–11:50 pm in WLH 2207. TA: Xiangjun Chen xic034@eng.ucsd.edu, section hours Tu 4–5pm, W 2–3 pm; office hours by appointment. My office hours by appointment.

Homework

There will be graded homeworks using Gradescope. They will be posted a week before they are due. No late homework will be accepted (except for Gradescope upload problems); turn in what you have done by the due time. Regrades: via Gradescope within a reasonable time.

Website

See above for Canvas.

Assessment

The grade in this course is based on homeworks, two midterms, and a final exam. An approximate division is 20%, 30% and 50%, but this remains to be seen. The midterms will be open-note (your hand-written material); the final will probably be open-note and open-textbook, No calculators, no cell phones, no external aids during midterm or final exams. There will be no make-up exams except in exceptional circumstances. Your final grade is the culmination of a quarter-long effort.
I encourage you to discuss the material among yourselves. When it comes to assigned homework however, everything you turn in should be essentially your own. If you and a friend have worked too closely on a problem, please say so. Needless to say, collaboration is not permitted during exams.

Prerequisites

Calculus, differential equations, some linear algebra, helpful to remember freshman physics. This is a graduate class. If you think you can master the material concurrently, that's fine, but you'll have to do the work.

Textbooks

There is no real textbook for the class, but most of the material follows *Mathematical Methods for Physics and Engineering* by Riley, Hobson and Bence 2006, Cambridge University Press, 3rd edition, but the edition isn't that important) and *Advanced mathematical methods for scientists and engineers* by Bender and Orszag. I have placed them on reserve at the library.

A classic reference on the subject as a whole is *Methods of Mathematical Physics* by Jeffreys & Jeffreys. A remarkable book even today. Two other good books on the material we cover, which concentrate on the physical background, are *Methods of Mathematical Physics* by Mathews & Walker, and *Mathematical Methods for Physicists* by Arfken (I prefer the second edition). Advanced textbooks on complex analysis with an applied bent are *Functions of a Complex Variable* by Carrier, Krook & Pearson, and *Complex Variable* by Ablowitz & Fokas.

You should start becoming familiar with mathematical handbooks. The one true word is in the *Handbook of Mathematical Functions*, formerly edited by Abramowitz and Stegun, but now replaced by the Digital Library of Mathematical Functions, available online and in hard copy. For integrals, series and products, see *Table of Integrals, Series, and Products* by Gradshteyn & Ryzhik (many editions).

Rough syllabus

I will cover material from Chapters 14–18 and 20–21 of RHB, but not all of it and not in the same order.

Basic solutions of linear and nonlinear ODEs. Green's functions for ODEs. Series solutions to ODEs. Sturm–Liouville theory. Phase plane analysis.

294B/203B (Winter) will cover approximate solutions to ODEs, multiple scales, phase plane, boundary layers, WKB and asymptotic methods. 294C/203C (Spring) will cover PDEs.

Academic integrity

See UCSD's policy on (there is a link on the class web page). Don't do it.

OSD Accommodation

Please come and see me in good time before exams etc. to discuss.

Stefan G. Llewellyn Smith

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Research interests:

Fluid dynamics. Vortex dynamics. Asymptotic methods. Applied complex analysis. Physical oceanography

Interests:

Japanese; food and cocktails; rowing; tennis (not enough time).

Education:

• Queens' College, University of Cambridge, 1993–Oct 1996. PhD 1996.

• Massachusetts Institute of Technology and Woods Hole Oceanographic Institution, 1992–1993.

• Queens' College, University of Cambridge, 1988–1992. Certificate of Advanced Study (Part III of the Mathematical Tripos) with Distinction, 1992. BA (Honours) First Class (Parts IA, IB & II), 1991.

Recent publications:

A-89 Wu, Y., Llewellyn Smith; S. G., Rottman, J. W., Broutman, D. & Minster, J.-B. H. 2020 Time-Dependent Propagation of Tsunami-Generated Acoustic-Gravity Waves in the

A-90 Chang, C. & Llewellyn Smith, S. G. 2020 Axisymmetric contour dynamics for buoyant vortex rings. *J. Fluid Mech.*, *887*, A28.

A-91 Stolerman, L. M., Getz, M., Llewellyn Smith, S. G., Holst, M. & Rangamani, P. 2020 Stability analysis of a bulk-surface reaction model for membrane-protein clustering. *Bull. Math. Biol.*, *82*, 30.

A-92 Hernández, E. S., Llewellyn Smith, S. G. & Cros, A. 2020 Resonance of a flexible plate immersed in a von Kármán vortex street. *J. Mech. Sci. Tech.*, *34*, 1459–1465.

A-93 Rocha, C., Constantinou, N., Llewellyn Smith, S. G. & Young, W. R. 2020 The Nusselt numbers of horizontal convection. *J. Fluid Mech.*, *894*, A24.

A-94 Chang, C. & Llewellyn Smith, S. G. 2021 Density and surface tension effects on vortex stability. Part 1. Curvature instability. *J. Fluid Mech.*, *913*, A14.

A-95 Chang, C. & Llewellyn Smith, S. G. 2021 Density and surface tension effects on vortex stability. Part 2. Moore–Saffman–Tsai–Widnall instability. *J. Fluid Mech.*, *913*, A15.

A-96 Christopher, T. & Llewellyn Smith, S. G. 2021 Hollow vortex in a corner. *J. Fluid Mech.*, *908*, R2.

A-97 Christopher, T. & Llewellyn Smith, S. G. 2021 Bounding temperature dissipation in time-modulated Rayleigh–Bénard convection. *Phys. Rev. Fluids*, *6*, L051501.

A-98 Protas, B., Llewellyn Smith, S. G. & Sakajo, T. 2021 Finite rotating and translating vortex sheets. *J Fluid Mech.*, *923*, A23.