

# Instability in Geophysical Flows

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## Notes for Instructors

The folder **sample\_executables** contains MATLAB files needed to solve problems 19 and 20.

In the folder **homework\_notes** you can find solutions and notes on each of the problems. Also included is a solution to project 5. These notes are not intended to represent the “ideal” solution that a student would submit to get a perfect mark. Rather, the intent is that the student will read them to gain insight into any problem that gave her trouble. Also included are extra explanations and other points that students may find interesting.

As with the main text, questions and suggestions are most welcome.

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## Weekly assignments for a 10-week course.

In a 10-week course with 4 hours of contact time and one homework assignment per week, I find that I can cover chapters 1-6 and 8. Chapters 7 and 9-13 are left for independent reading and possible term projects. What follows is the homework assignments for the 2018 iteration of the course. - W. Smyth

### Homework 1

- 1: First derivative matrix
- 2: Second derivative matrix
- 3: Differential eigenvalue problem

### Homework 2

- 4: Benard convection
- 5: A convective mixed layer
- 6: An unstable layer in an inviscid fluid

### Homework 3

- 7: Numerical analysis of shear instability

8: The piecewise-linear shear layer: numerical solution

#### **Homework 4**

9: Transforming the Rayleigh equation

10: Energy analysis for a shear layer

11: The Bickley jet

12: Sinusoidal flow

#### **Homework 5**

13: The fourth-derivative matrix

14: Matrix solution of the Orr-Sommerfeld equation

15: Wave resonance in a jet

16: A convectively unstable layer in an inviscid fluid, revisited.

#### **Homework 6**

17: Instability of a separating boundary layer

18: Instabilities in a plunging downslope flow

#### **Homework 7**

19: Sheared convection

20: Instabilities of the Eady model