Dynamical Systems in Geosciences

Overview

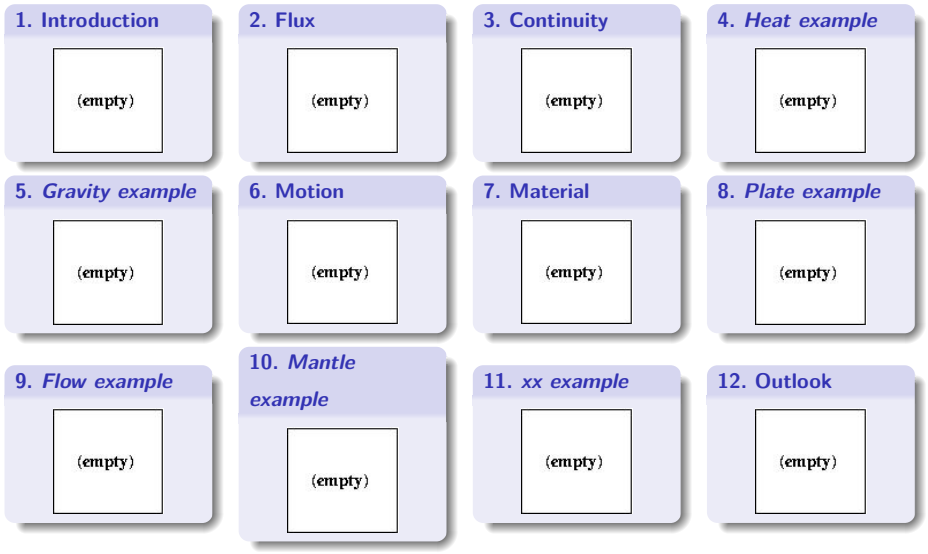
Overview: Structure of lecture

Structure of lecture

This lecture introduces **dynamical systems** as a physical model to discuss problems in geosciences.
We will use mathematical methods to **describe** processes acting on and within the Earth, which often have a dynamical character. We will discuss concepts such as

- **Flux**, representing the **movement** of a quantity in space and time (examples: heat flux, groundwater flux, mass flux, ...).
- **Continuity** as a concept describing the **transport** of the quantity (e.g. continuity of mass, energy, momentum, charge, ...).
- **Differential equations** for **motion** and **material**.

Overview: Lectures



Overview: Tentative schedule

Week

1. Overview
2. Introduction
3. Flux
4. Continuity
5. Motion
6. Material
7. Gravity
9. Example: XX
10. Example: XX
11. Example: XX
12. Example: XX
13. (spare time)
14. Exam

Overview: Exercises and Seminar

Exercises

- We will have practical exercises, which follow some of the (mathematical) concepts introduced in the lectures.
- We introduce PYTHON as simple programming language.
- For some of the lectures a link is given to a running JUPYTER NOTEBOOK.
- Explore and play with it!

Seminar

- We discuss and run the concepts developed in the lectures with practical exercises in PYTHON.
- We discuss the different **functions and methods** as learning examples ...
- ... and we will introduce the **geophysical exercises**, and discuss the progress in coding them.
- The coded geophysical exercises should be **handed in** as jupyter notebook to: dropdown

Overview: Suggested reading

Suggested reading

- Faires, J. D. & Burden, R. L. (2000).
  Numerische Methoden. Näherungsverfahren und ihre praktische Anwendung.
  Spektrum Verlag.
- Press, W. H., Teukolsky, S. A., Vetterling, W. T. & Flannery, B. P. (1999).
  Numerical Recipes in Fortran.
  Cambridge University Press.
- Turcotte, D.L. & Schubert, G. (1982).
  Geodynamics.
  J. Wiley, UK.