

Multiscale Hydrodynamic Phenomena

This course aims to provide the basics of asymptotic methods: Matched Asymptotic Expansion, Multiple Scale Methods, WKB method, Homogenization, Boundary Layers...

We focus on the influence of a parameter, say epsilon, on the behavior of a differential equation when the parameter is smaller and smaller.

Methods are applied first on simple oscillators (mass/spring). Then we present examples of influence of small parameters in fluid mechanics. For example we look at the behavior of the Navier Stokes equations at small Reynolds (Stokes and Oseen), at small inverse of Reynolds number (Boundary Layer, separation: Triple Deck) or small depth (Shallow Water, KDV equation, nodular bores...)...

Prerequisite: Overall, a basic Master 1 level in applied maths, physics or mechanics is required

Bibliography:

1. Fluid Dynamics, Part 2 Asymptotic Problems of Fluid Dynamics Anatoly I. Ruban (2015)
2. Perturbation methods J. Hinch Cambridge University Press, (1991)

Timing: The Course offered in the first part (sept-nov) of the M2 year.

Credits: 3 ECTS

Hours: 30 hours.