Mechanics of Turbulence

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Program:

Introduction
Mathematical description of turbulence.

Turbulence Statistics
Mean values.
Turbulent intensity.
Spatio-temporal correlation functions.

Stationarity and Homogeneity
Stationarity and homogeneity in turbulence.
Relevant turbulence scales.

Numerical Solution of the Navier-Stokes Equations
Reynolds equations.
Kinetic energy of the mean flow.
Turbulent kinetic energy equation.
Vorticity dynamics.
Vorticity in the Navier-Stokes equations.
Vorticity equation.
Kelvin circulation theorem.
Vortex stretching.
Energy spectrum.
Taylor hypothesis.
Energy cascade.

This extended program provides a comprehensive overview of topics related to turbulence and the Navier-Stokes equations, offering a solid foundation for understanding these complex subjects.

References:

Lanzoni, S. 2010. Advanced Fluid Mechanics
Batchelor, G. K. (1953). The theory of homogeneous turbulence. Cambridge university press.

Examination and grading:

Oral with presentation of an homework