Course Syllabus

Vm524

Turbulence

2018 Fall

Course Description:

A graduate course listed in SJTU's Honors Program, aiming to offer the SJTU graduate students an advanced and high-quality course to know the fundamentals of turbulence.

Instructor:

Name: Lipo Wang
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Phone: 15900923960
Office: Room JI Building 524
Office hour: working time

Textbook (Author, Book Title, Publisher, Publication Year, ISBN**):**

Recommended reference books:

1. *A First Course in Turbulence*, H. Tennekes and J.L. Lumley, MIT 1972

2. *Turbulent Flows*, S. Pope, Cambridge (2000)

3. other references: *Turbulence* (U. Frish), *Turbulence* (C. Bailly & G. Comte-Bellot),

notes for turbulence modeling

Course Prerequisites: Fluid mechanics

Course Website: N/A

Grading Policy (Assignments %, Project, Exams, etc.)**:**

Homework (25% in total)

One medium-term exam (30%)

One topic research report (10% in total)

One final oral exam (grading weighting factor: 35%)

Honor Code Policy:

It is very necessary to show up in the class. Homework assignments need to finish independently and submit on time. Frequent discussions and exchanges with the instructor are strongly encouraged. To make a fair judgment of learning, strict rules related to homework assignments and exams need to be formulated without exception. Any honor code violation behavior (e.g. plagiarism) must be recorded with corresponding penalty.

Teaching Schedule:

Week	NO.	Date	lectures and Exams	Comments
1	1		The nature of turbulence： turbulence physics	
	2		; phenomenological description of turbulence	
2	3		Methods of analysis: dimensional analysis, local invariance	
	4		, Reynolds decomposition, emsamble average	
3	5		Kinetic description of gases	
	6		mathematical description, Karman-Harwarth equation	
4	7		National holiday	
	8		National holiday	
5	9		Energy cascade: scales in turbulence	
	10		Flow dynamics and vorticity dynamics based on governing equations	
6	9		Free shear turbulence: governing equiations	
	10		Modeling ideas, self-similarity	
7	11		Free shear turbulence: scaling relation	
	12		Results and analysis	
8	13		Midterm exam	
	14		Wall shear turbulence: governing equation	
9	15		Wall shear turbulence: mean profiles, Reynolds stress	
	16		Wall shear turbulence: length scales	
10	17		Wall shear turbulence: turbulent boundary layer structure and the thickness evolution	
	18		Passive scalar transport in turbulence	
11	19		Introduction of turbulence models and DNS (direct numerical simulation): DNS	
	20		Introduction of turbulence models and DNS (direct numerical simulation): large eddy simulation	
12	21		Introduction of turbulence models and DNS (direct numerical simulation): dynamic sub-grid models	
	22		Specific topic: intermittency: theory and models	
13	25		Course review	
	26		Final exam	