SUBJECT DATA SHEET AND REQUIREMENTS

last modified: 5th December 2013

LARGE-EDDY SIMULATION IN MECHANICAL ENGINEERING
NAGY ÖRVÉNY SZIMULÁCIÓ A GÉPÉSZETBEN

1	Code	Semester Nr. or fall/spring	Contact hours/week (lect.+semin.+lab.)	Requirements p / e / s	Credit	Language
	BMEGEÁTMW05	**3.(4.*)spring**	**1+1+0**	**p**	**3**	**English**

*: in case of enrolment in fall

2. Subject's responsible:

Name:	Title:	Affiliation (Department):
Dr. Gergely KRISTÓF	associate professor	Dept. of Fluid Mechanics

3. Lecturer:

Name:	Title:	Affiliation (Department):
Dr. Gergely KRISTÓF	associate professor	Dept. of Fluid Mechanics
Dr. Máté Márton LOHÁSZ	invited lecturer	GEA EGI Co. Ltd.

4. Thematic background of the subject: Basics of turbulence theory

5. Compulsory / suggested prerequisites:
Compulsory: -
Suggested: -

6. Main aims and objectives, learning outcomes of the subject:
First objective is to get familiar with the concept of Large-Eddy Simulation, and its most commonly used techniques. A secondary objective is to gain knowledge about post-processing techniques especially suited for instantaneous and steady 3D flow data. Applications from turbulent heat transfer and noise production will be shown.

7. Method of education: lecture 1h/w, seminar 1h/w, laboratory 0h/w. The theory will be presented in the form of lectures. Tutorials are prepared to enable the students to carry out a Large-Eddy Simulation on their own. Typical test cases are prepared to enable the students to perform easily experiments on simulation parameters or to gain experience in post-processing of the results.

8. Detailed thematic description of the subject:
Motivations: why to use Large-Eddy Simulation (LES).
Filtering of the incompressible Navier-Stokes equations, basic filter properties.
Numerical requirements of the simulation.
Subgrid scale modelling approaches.
Interacting error dynamics.
Practical aspect of the simulation (domain time and mesh requirements).
Special LES boundary conditions: inlet turbulence generation.
Introduction to hybrid and zonal LES/RANS approaches.
Postprocessing of LES results: flow topology description, vortex detection methods.
Case studies: internal cooling channel, flow around an airfoil, near field of a jet.

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9. Requirements and grading

a) in term-period:

2 written mid-term exams, 1 homework (about LES, documented and presented), 1 mid-term practical assignment (to be carried out during seminar about post-processing)

1st exam:	7th week	(max.25points / min.40% = 10points)
2nd exam:	14th week	(max.25points / min.40% = 10points)
homework:	10th week	(max.35points / min.40% = 14points)
Presentation of the homework:	11th week	(max. 5points / min.40% = 2points)
During seminar assignment:	13th week	(max.10points / min.40% = 4points)

Totally achievable is max.100 points (100%) as base of the final grading, min. 40% is needed from each to pass. Late submission of homework one week or later with 20% penalty. Last deadline of the submission of homeworks is the last day of the 14th week.

Grading: 0%-39%: fail(1); 40%-54% pass(2), 55%-69%: satisfactory (3), 70%-84%: good(4), 85%-100%: excellent (5)

b) in examination period: -

c) The students are subject to disciplinary measures against the application of unauthorized means at mid-terms, term-end exams and homework and the application of the 1/2013. (I.30.) Dean's Order must be followed.

10. Retake and repeat

Retake possibility for mid-term exams 1. & 2. is on the next weeks (8th and 15th), repeated retake of the test 1. or 2. is on the 15th week. Any further movements are due to the Code of Studies and Exams of BME.

11. Consulting opportunities:

Consultation hours: by email appointments and as it is indicated on the department's website. Two consultations are available for the homework (2 and 1 weeks before submission) and one for each mid-term exam (two days before the exam).

12. Reference literature (compulsory, recommended):

- Lesieur, M.; Métais, O. & Comte, P.: Large-Eddy Simulations of Turbulence, Cambridge University Press, 2005
- Pope, S.B.: Turbulent Flows, Cambridge University Press, 2000
- Sagaut, P.: Large Eddy Simulation for Incompressible Flows. An Introduction, Springer, 2002
- Geurts, B.J.: Elements of Direct and Large-Eddy Simulation, R.T. Edwards, Inc., 2003
- Downloadable materials: www.ara.bme.hu/oktatas/tantargy/NEPTUN/BMEGEATMW05

13. Home study required to pass the subject:

Contact hours	28	h/semester
Home study for the courses	12	h/semester
Home study for the mid-semester checks	10	h/check
Preparation of mid-semester homework	20	h/homework
Home study of the allotted written notes	0	h/semester
Home study for the exam	-	h/semester
Totally:	**90**	**h/semester**

14. The data sheet and the requirements are prepared by:

Name:	Title:	Affiliation (Department):
Dr. Máté Márton LOHÁSZ	invited lecturer	GEA EGI Co. Ltd.

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