“Nonlinear deformation of solids in particular rubber” in February 2016

for students of the master course “Mathematical Modelling of Mechanical Systems”

Procedures:

The assessment consists of two parts:

(1) Example problems will be disseminated after every 2 h worth of lectures. The solution to the problems will be presented by students during the next meeting. Depending on the number of students each student will present his/her solutions at least twice or more in a small oral presentation (max. 10 min. of chalk & blackboard and/or power-point). In order to facilitate learning the students may form small learning groups. Members of each learning group may assist the presenting student while he/she is answering questions on his/her presentation. For the presentation and for the performance during answers the student group will be given marks ranging between 40 (passed) to 100 (most excellent).

(2) At the end of the course a 1-2 h individual written test will be performed. The student will earn marks between 40 (passed) to 100 (most excellent).

The marks of (1) and (2) will be added and form the final mark on a 50-50% average between both parts.

Recommended literature:

[1] I. Müller, P. Strehlow. Rubber and rubber balloons: paradigms of thermodynamics. Vol. 637. Springer Science & Business Media, 2004, (djvu will be provided)

[2] I. Müller, Thermodynamics, Interaction of Mechanics and Mathematics Series. Pitman, Boston 338 (1985): 20. (djvu will be provided)

[2] I. Müller, W. Weiss, Müller, I., & Weiss, W. (2006). Entropy and energy: A universal competition. Springer Science & Business Media. (djvu will be provided)

[4] C. Truesdell, W. Noll. The non-linear field theories of mechanics. Springer Berlin Heidelberg, 2004, (djvu will be provided)

Other literature will be presented during the course if required.

Schedule:

Contact hour	Topic
1: **Monday** 15/02/2016 10:00-11:00	Introductory remarks, stability of rubber balloons, kinetic theory of rubber;
2: 11:00-12:00	kinetic theory of rubber, cont.; notion of entropy induced pressure
3: 12:00-13:00	cont.
4: 13:00-14:00	Student's problem session
5: **Tuesday** 16/02/2016 10:00-11:00	Elements of nonlinear elasticity
6: 11:00-12:00	cont.
7: 12:00-13:00	cont.
8: 13:00-14:00	Student's problem session
9: **Wednesday** 17/02/2016 10:00-11:00	Biaxial stretching of a rubber membrane
10: 11:00-12:00	cont.
11: 12:00-13:00	cont.
12: 13:00-14:00	Student's problem session
13: **Thursday** 18/02/2016 10:00-11:00	Stability of a single rubber balloon
13: 11:00-12:00	cont.
14: **Friday** 19/02/2016 10:00-11:00	cont.
15: 11:00-12:00	Student's problem session
16: 12:00-13:00	Stepwise inflation of a balloon
17: 13:00-14:00	cont.
18: **Saturday** 20/02/2016 10:00-11:00	Student's problem session
19: 11:00-12:00	Stability of two rubber balloons
20: 12:00-13:00	cont.
21: 13:00-14:00	Student's problem session
22: **Wednesday** 24/02/2016 10:00-11:00	Multi-balloon stability: A mechanical model of a phase transition
23: 11:00-12:00	cont.
24: 13:00-14:00	cont.
25: **Thursday** 25/02/2016 10:00-11:00	Final written exam
26: 11:00-12:00	cont.