Mecânica de Estruturas Aeroespaciais

2021.1

by prof. Artem

Objectives

- Study of the fundamental theories of mechanics of the structural elements applied in aerospace systems (mostly aeronautical systems):
  - stress analysis (predominantly);
  - determination of the deflection.
- Analytical solution of the problems concerning structural elements under applied loads.
- Study of structural behavior of the basic components of the aerospace systems.
- Application of the finite element method to solve practical problems with use of computer-aided engineering software (Ansys Workbench).

Online Methodology

- Video classes:
  - Theoretical aspects
  - Problem solving
- CAE analysis (Ansys Workbench)
- Self-preparation:
  - Revision of the theory
  - Revision of the analytically solved problems
  - Individual works
  - Practical works
  - Mini-project
  - Answers to questions (to prove the presence)
- Interaction with professor
  - online
  - with use of forum

Topics of the Syllabus (in Portuguese)

Modulo 1 – Introdução
-Equações básicas – *Trabalho Individual 1

Modulo 2 – Preparação para miniprojeto
-Flexão de vigas – Trabalho Individual 2
-Cisalhamento de seções fechadas e abertas – Trabalho Individual 3
-Introdução a mecânica de fratura – **Exercício individual 2
-Vasos de pressão – Exercício individual 3
-Torção de seções abertas e fechadas – Trabalho Individual 4
-Seções combinadas – ***Miniprojeto
-Idealização estrutural – Miniprojeto

Modulo 3 – Colunas e placas finas
-Flambagem de colunas - Exercício individual 4 e 5
-Flexão de placas finas - Trabalho individual 5
-Flambagem de placas finas - Exercício individual 6 / Trabalho individual 6

* **Trabalho individual** inclui as tarefas que devem ser resolvidas por métodos analíticos
****Exercício individual** inclui as tarefas que devem ser resolvidas por meio de Ansys Workbench, além disso a solução deve ser verificada por método analítico e o erro das soluções devem ser avaliado
*****Miniprojeto** é um trabalho individual expandido que inclui a aprendizagem individual de um tópico teórico

Evaluation system

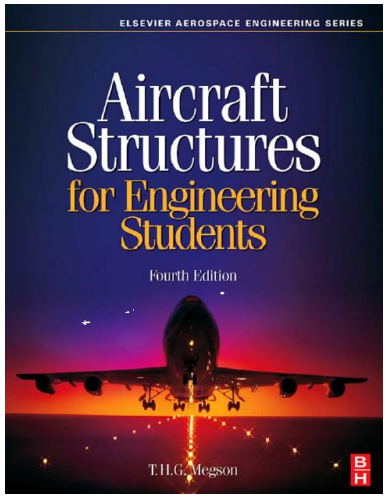
No.	Type	UnB Points
1	**Individual works / Trabalhos individuais**	6.0
2	**Individual exercises /Exercícios individuais**	3.0
3	**Mini-project / Miniprojeto**	1.0
	TOTAL:	**10.0**

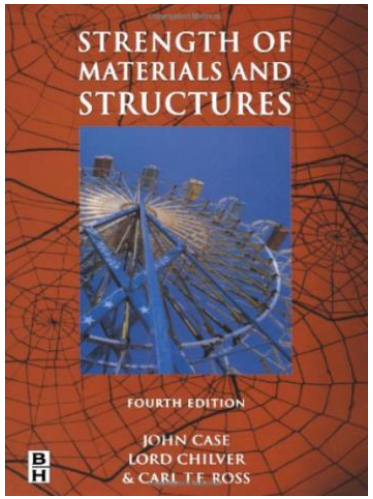
Attention! Additional criterions:

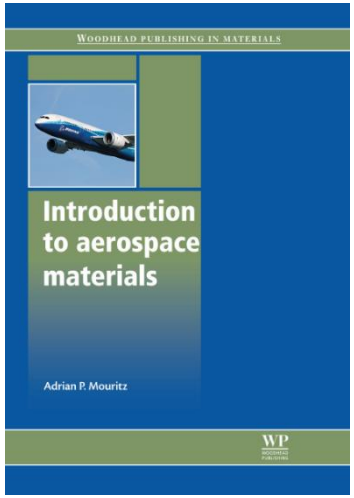
- To accomplish the course, every student have to gain at least 50% of maximum grade (i.e. more then 5 UnB points).
- Mini-project is not obligatory
- Evaluation of the presence is based on answers to questions (student must to answer at least 50% of the questions for the given topic to be considered as present). Since some topics extends to couple of days, be careful with the answers: when more then 50% of answers are wrong, the student is considered as absent in all days of the topic. The student will be excluded from the course if he skips more then 25% of classes (standard UnB rule).
- Individual exercise 1 is not evaluated
- If the way of solution is correct, but the final result is wrong (or out of the error tolerance), the mark for the work is ZERO!

Basic literature (theory)

- **The principal book of the course is** Megson, T.H.G. Aircraft Structures for Engineering Students. – Fourth Edition, 2007. – 804 p. (most of the topics)
- Case, J., Chilver, L., Ross, C.T.F. Strength of Materials and Structures. – Fourth Edition. – 706 p. (theory of pressure vessels/thin shells under internal pressure)
- Adrian P. Mouritz. Introduction to aerospace materials. – 2012. – 621 p. (introduction to fracture mechanics)







Extra literature (theory)

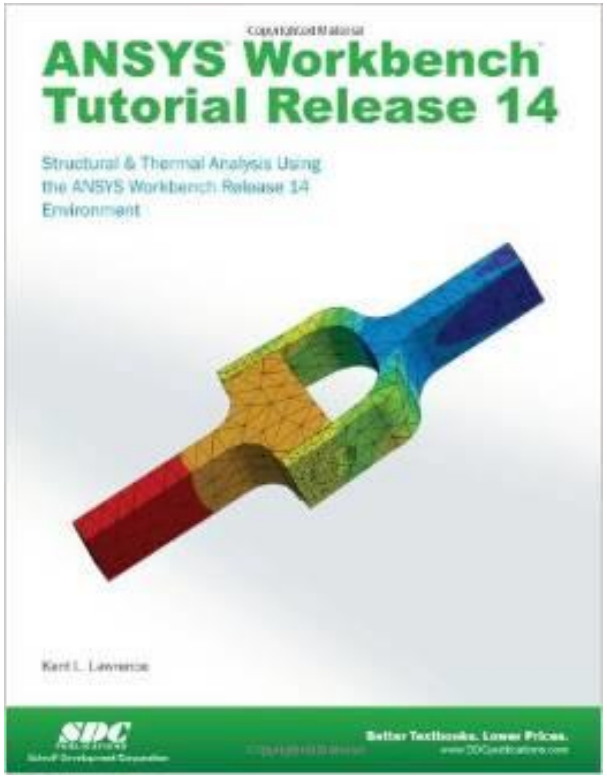
Applied literature

- Bruhn, E.F. Analysis and design of flight vehicle structures. – 1973. - 817 p. – Every structural engineer must have this book
- Michael C.Y. Niu. Airframe structural design. – Second printing, 1989. – 612 p.
- Kuhn, P. Stresses in aircraft and shell structures. – McGraw-Hill Book Company, Inc., 1956. – 436 p.

Classical theory

- Urugal, A.C. Stresses in plates and shells. – McGraw-Hill. Inc., 1981. – 318 p.
- Timoshenko, S. Strength of Materials. Part II: Advanced Theory and Problems, 1939. – 510 p.

Literature (Practical)

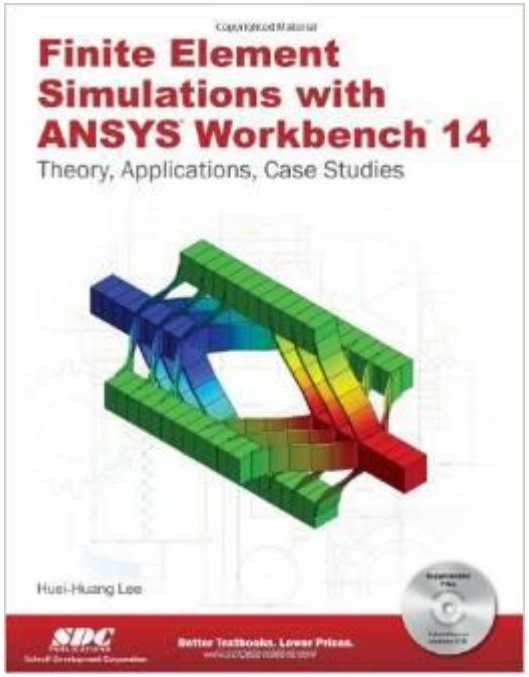


ANSYS Workbench Tutorial Release 14
by Kent Lawrence

Chapters (will be covered – **bold**)

1. Solid Modeling Fundamentals
2. Placed Features, Assembly
3. Modeling Techniques
4. ANSYS Mechanical I
5. ANSYS Mechanical II
6. Wizards & Tools
7. Heat Transfer & Thermal Stress
8. **Surface** & Line Models
9. Natural Frequencies & **Buckling Loads**
10. Nonlinear Problems

Extra Literature (Practical)



Lee H.H. Finite Element Simulations with ANSYS Workbench 14: Theory, Applications, Case Studies. – 594 p.

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Obrigado!