ROMANIAN ACADEMY
School of Advanced Studies of the Romanian Academy (SCOSAAR)
COURSE SHEET: ‚Dynamical Systems, Friction Laws in Rigid Solid Mechanics and Continuum Mechanics'

1. Program Information

1.1 Department	Department of engineering, mechanical, computer sciences
1.2 Institution	Romanian Academy
1.3 Field of studies	Engineering sciences
1.4 Cycle of studies	PHD

2. Course information

2.1 Name of the course			**Dynamical Systems, Friction Laws in Rigid Solid Mechanics and Continuum Mechanics**				
2.2 Holder of course activities			Nicolae POP, CSI dr. habil.				
2.3 Holder of seminar activities			Nicolae POP, CSI dr. habil.				
2.4 Holder of laboratory activities							
2.5 Year of study	**I**	**2.6 Semester**	2	**2.7 Type of ssessment**	E*	**2.8 Course regime**	DS**

3. Estimated total time (hours per semester of teaching activities)

3.1 Number of hours per week	15	**From which:**			
3.2 course	9	**3.3 seminar**	6	**3.4 laboratory**	0
3.5 Total hours from the curriculum	210	**From which:**			
3.6 course	126	**3.7 seminar**	84	**3.8 laboratory**	0
3.9 Total hours per semester	210				
3.10 Number of credits	15				

4. Course content

1. Notions and properties of dynamic systems.
2. Autonomous and non-autonomous linear systems.
3. Linear vibrations and nonlinear dynamic systems.
4. Definition of the phenomenon of dry friction. The static coefficient and the dynamic coefficient of friction, the Amontons-Coulomb dry friction law. Frictional force, apparent contact area and normal pressing force; the nature of the materials of the bodies in contact and the normal pressing force
5. The mathematical model of the contact problem with friction in linear elasticity. Signorini's problem with friction in linear elasticity.
6. Numerical methods of approximation of dynamic problems of elastic contact with friction. Discretization of variational inequalities, duality methods and mixed incremental formulations.
7. Algorithms and finite element methods in solving problems of elastic contact with friction.

5. The objectives of the course and the specific skills acquired

1. The general objective of the discipline: Knowledge and understanding of the basic notions of dynamic systems, the main laws of friction and contact problems with dry friction from the mechanics of rigid solids and deformable rigids
2.- Specific objectives:
Acquiring knowledge in the application of algorithms and the use of software containing the analyzed methods.
- The study of dynamic systems, the application of calculation programs to solve frictional contact problems.
- Examples of numerical solutions using finite element methods.

6. Bibliography

1. Voinea, R., Stoe, I., *Introducere in Teoria Sistemelor Dinamice*, 2000, Editura Academiei Romane, Bucuresti.
2. Pop, N., *Variational Analysis and Numerical Methods for Contact Problems in Elasticity,2009,* Editura Universitatii de Nord, Baia Mare.
3. Stanescu, D, Muneteanu, L, Chiroiu, V, Pandrea, N, N. *Sisteme dinamice,* Vol.1,2, Ed.Academiei, 2007, 2011
4. Fischer-Cripps, A., *Introduction to Contact Mechanics*. Second Edition. 2007, Springer.
5. Laursen, T., *Computational Contact and Impact Mechanics*, 2003, Springer-Verlag Berlin Heidelberg.
6. Galin, L.A., *Contact Problems,* 2008, Springer.
7. Wriggers, P., *Computational Contact Mechanics.* Second Edition, 2006, Springe.r
8. Konyukhov, A., Schweizerhof, K., *Computational Mechanics*, 2013, Springer.
9. Lefter, C-G., *Ecuatii diferentiale si sisteme dinamice*, Editura Alexandru Myller, Iasi, 2006

7. Assement

Type of activity	7.1 Evaluation criterias	7.2 Evaluation methods	7.3 Weight of the final grade
7.4 Course	Knowledge acquired	Written exam	55%
7.5 Seminar	Activity	Case studies presented	45%
7.6 Laboratory			
7.7 Standard minim de performanţă: Cunoașterea a 70% din informația conținută în curs			

*E = Exam. C = Colloquium.

Course structure

June 2024 – October 2024 – Didactic activity - Dynamic Systems, Friction Laws in Rigid Solid Mechanics and Continuum Mechanics, IMSAR

Exam

October 2024

Course owner: Dr. Nicolae Pop