UNIVERSITY OF CRAIOVA
Faculty of Mathematics and Computer Science
Department of mathematics
Fundamental domain : Exact sciences
Domain: Mathematics
Master : Applied mathematics
Form : Day classes
Duration of studies : 2 years
Approved with academic year 2009-2010

The mathematics of contact models
Syllabus

Course coordinator: Lect.dr. Matei Andaluzia
Code: MA225
Second Cycle: MASTER
Second Year , Semester 2, Course 28 hours, Seminar 28 hours
No. of credits: 7
Domain: Mathematics
Type : compulsory
Category: complementary

Objectives : To introduce the theory of variational inequalities with emphasis on the study of contact models. We are interested in the weak solvability of the proposed models.

Necessary background : Partial differential equations, Mathematical modeling with differential equations, Functional analysis.

Evaluation : Coloquium (C).

Contents:

1. Preliminaries
Function spaces and properties. Trace theorems. Green-type formulas. Poincaré–type inequalities. Korn's inequality. Elements of convex analysis.

2. Variational inequalities
Elliptic variational inequalities. Elliptic quasi-variational inequalities. Variational problems with Lagrange multipliers.

3. Applications in Contact Mechanics
Frictional bilateral contact problems. Frictionless unilateral contact problems.

Bibliography:

G. Duvaut, J.L. Lions, Les inequations en mecanique et en physique, Dunod, Paris, 1972.
I. Ekeland and R. Temam, Convex analysis and variational problems (Studies in mathematics and its applications; 1) North-Holland Publ. Comp. 1976.
W. Han and M. Sofonea, Quasistatic contact problems in viscoelasticity and viscoplasticity, Studies in Advanced Mathematics, American Mathematical Society, International Press, 2002.
J. Haslinger, I. Hlavacek and J. Necas, Numerical methods for unilateral problems in solid mechanics, in Handbook of Numerical Analysis, vol IV, North – Holland, Amsterdam, 1996, 313-485.
S. Hüeber, A. Matei and B.Wohlmuth, Efficient algorithms for problems with friction, SIAM Journal on Scientific Computing, vol. 29, 70-92, 2007.
D. Kinderlehrer and G. Stampacchia, An Introduction to Variational Inequalities and Their Applications, SIAM, 2000.
M. Sofonea and A. Matei, Variational Inequalities with Applications. A study of Antiplane Frictional Contact Problems, Advances in Mechanics and Mathematics, Vol. 18, Springer, 2009.