Current Topics in Continuum Mechanics. I,
Edited by Lazăr Dragoş,

Introduction

The high level didactic activity cannot be separated from a sustained research activity. The most efficient framework in which these activities may simultaneously develop has been acknowledged to be the scientific seminars. The understanding of the importance of this form of interweaving between teaching and research determined outstanding professors to organize two scientific seminars within the Department of Mechanics and Equations belonging to the Faculty of Mathematics of the University of Bucharest. The first one is the Seminar of Fluid Mechanics and Applied Mathematics founded by the regretted professors Victor Vâlcovici and Caius Iacob in 1950 and the second is the Seminar of Deformable Media organized by professors Gr. C. Moisil and Nicolae Cristescu.

The topics of these seminars cover various subjects from general mechanics and mechanics of continua up to the most refined mathematical methods used in mechanics.

Within these meetings original works of high level are presented, the results of Ph.D. thesis are debated and new directions in research are studied. The results communicated are going to be published in national and international journals of prestige. Unfortunately, the publication of the papers in journals or in conference proceedings often is restricted to a limited number of pages imposing sometimes the abridgement of the text. That is why the issue

of a volume series, entitled Current Topics in Continuum Mechanics, that would include original papers presented at the seminars and translated in a language of international circulation, has been necessarily imposed.

The present volume that opens a series we hope to be able to sustain financially comprises 6 chapters arranged following the authors' alphabetical order. Further, we briefly present their contents.

i) *Numerical and qualitative study of fluid jets* – Adrian Carabineanu

The model Helmholtz-Kirchhoff associated to the flow of a fluid jet into the atmosphere is studied, the problem being reduced to a system of nonlinear equations. Previous author's results concerning the existence of the solution are reanalyzed. Then, a semi-inverse method for the calculation of the free lines of the jet whose walls consist of either arcs of circle or semi-infinite straight lines is presented and discussed.

ii) *Large elasto-plastic deformations for crystalline materials* – Sanda Cleja-Ţigoiu

A constitutive framework for the description of the behaviour of elasto-plastic materials is presented and the role of the relaxed and isocline current local configurations is put in evidence. Then, some classes of anisotropic materials (transversal isotropic, orthotropic) that model composite materials are presented. The role of the plastic spin upon the description of the behaviour of such materials is studied. There are formulated variational inequalities for describing rate type quasi-static problems. Finally it is evidenced the behaviour of these materials subjected to movements with homogeneous deformations and is developed a study regarding the occurrence of the possible bifurcations of the solutions.

iii) *Analytical and numerical approach to Richards' equation* – Stelian Ion, Gabriela Marinoschi and Dorin Marinescu

In this chapter there are presented analytical and numerical solutions of boundary-value problems with initial conditions attached to Richards' nonlinear parabolic equation. There are investigated some mathematical models corresponding to unsaturated soils characterized by certain hydraulic properties (Gardner's exponential model, Broadbridge's model) for which analytical solutions may be obtained. The mathematical properties of the numerical solutions for other models (e.g. Philip's model and van Genuchten's model) are discussed. Numerical results are provided and the graphics are represented using the software "Gnuplot".

iv) *Creep, damage and failure around rectangular-like galleries* – Iuliana Paraschiv-Munteanu

The chapter presents the determination of the strains and displacements around a cylindrical horizontal cavity (with noncircular section). For this purpose the rock is modeled by the means of a visco-plastic model proposed by N. Cristescu. There are discussed problems related to the compressibility and dilatancy around the cavity, the damage and/or the wall closure in time.

v) *Functional framework for linear variational equations* – Ioan Roşca

The paper presents a unitary approach of abstract variational equations with applications to the study of the boundary value problems for partial derivative equations and systems of equations. A new proof of the existence and uniqueness of the variational equations with restrictions is given and the role of F. Brezzi's inf-sup condition is emphasized. Also, an elementary proof of J.L. Lions' regularity lemma is presented and a simple proof of Korn's inequality is obtained. The results are particularized to the study of boundary-value problems in mechanics.

vi) *Uniqueness and asymptotic stability for some fluids of differential type* – Victor Ţigoiu

The paper gives a definitive response to the problem raised by D.D. Joseph regarding "the existence of polynomial fluids" (at least for the fluids of third degree). Indeed, without using the well known theorem of functionals representation (of Coleman and Noll) and on the basis of *à priori* estimations obtained in the proof of the uniqueness of the problem with initial and boundary conditions, it is proved that the rest state is asymptotic stable, regardless the sign of the second Rivlin-Ericksen tensor (for the fluids of third degree). In consequence, at least this class of polynomial fluids may exist in the sense of Joseph's assertion.

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