

Continuum Mechanics

Professor: Arturo Tagliacozzo

☎081676832

email:arturo.tagliacozzo@unina.it.

SSD FIS/03

Course
Credit 8

Year (I, II) II

Semester (I, II) I

CONTENTS

Program of Continuum Mechanics for Geophysicists

PHENOMENOLOGICAL INTRODUCTION TO ELASTICITY: elastic forces, pressure, phenomenological constants. Hooke law.

DISPLACEMENT AND STRAIN: strain tensor. Cauchy's stress tensor and stress theorem.

CONTINUITY EQUATIONS Mass and momentum conservation. Newton's Law for a continuum. Energy variation of a deformable body under an applied stress. Elasticity tensor. Cauchy's laws of motion

STRESS ANALYSIS: Mohr circle in 2D and 3D. Normal and shear stresses. Coulomb theory of faulting. Normal and strike-slip faults and dip-slip faults.

THERMAL STRESS Thermodynamics of deformable continuum body. Heat conduction and Fourier equation. Elastic energy in the isothermal and adiabatic case. Application to geothermics: model for the temperature of the crust, thermal effect on the stress with Finite Element Method.

BASICS OF FLUID statics and DYNAMICS: Stevino's and Archimede's law. Velocity of sound. Bernoulli theorem. Viscous fluid and Navier-Stokes equation. Energy balance in a fluid. Hagen-Poiseuille flow. Couette flow Reynolds number. Laminar and chaotic flow. Vortices.

FREE CONVECTION. Similarity in the dimensionless Navier-Stokes equation: Prandtl and Nusselt numbers; Boussinesq approximate solution. When the convection starts: Rayleigh number.

BIBLIOGRAPHY

Feynman, Leighton, Sands, Feynman lectures on physics/ La fisica di Feynman (edizione bilingue), Longman

Atkin e Fox, An introduction to the theory of elasticity, Longman

Landau e Lifshitz, A course on theoretical physics: vol 7, Theory of elasticity, Pergamon press

Jaeger e Cook, Fundamentals of rock mechanics, Chapman and Hall

Batchelor, An introduction to fluid dynamics, Cambridge university press

Landau e Lifshitz, A course on theoretical physics: vol 6 Fluid mechanics, Pergamon press