# Mathematical Physics

## prof. Alessandro Musesti

***COURSE AIMS AND INTENDED LEARNING OUTCOMES***

The course aims at teaching the student to formulate and solve some variational problems of Continuum Mechanics, in particular in the framework of three-dimensional linearized and nonlinear elasticity. At the end of the course, the student will know the principal techniques of the three dimensional Calculus of Variations and will be able to develop sound mechanical models which are well posed from the mathematical viewpoint.

***COURSE CONTENT***

Introduction to the classical calculus of variations. Direct methods. One-dimensional and multi-dimensional case.

Variational principles in linearized elasticity. Boundary value problems. Local existence results.

Variational problems and functional spaces. Convex functions. Weak semicontinuity. Convex densities. Quasiconvexity. Polyconvexity and rank-one convexity.

Applications to nonlinear elasticity: John Ball's existence results. Isotropic and transversally isotropic materials. Examples of applications to biological materials. Ogden's materials.

***READING LIST***

P. Ciarlet, *Mathematical elasticity,* v. I, North Holland 1988.

Additional lecture notes will be provided during the course.

***TEACHING METHOD***

Classroom lectures.

***ASSESSMENT METHOD AND CRITERIA***

There will be an oral examination at the end of the course, aimed at evaluating the knowledge and the expertise of the student about the topics of the course. The exam will lasts about 45 minutes.

***NOTES AND PREREQUISITES***

Some notions on Vector Calculus, Lebsgue Spaces, and Continuum Mechanics are required. The main concepts will be recalled during the course.