

Mathematical Foundations of Nonlinear Elasticity January - March 2012. Prof John Ball

Abstract: The course will describe results and open problems related to the existence and properties of solutions in nonlinear elasticity. No previous knowledge of elasticity theory will be assumed. However, some familiarity with the calculus of variations, Sobolev spaces and weak convergence is desirable.

Variational formulation of elastostatics and its thermodynamic origin. Properties of the stored energy function. Constitutive inequalities, including quasiconvexity, rank-one convexity and polyconvexity.

Existence of energy minimizers for e.g. rubber-like materials. The equilibrium equations and smoothness of solutions. Uniqueness and nonuniqueness.

Invertibility of solutions.

Singularities: cavitation and phase boundaries.

Nonexistence of minimizers and microstructure.

Elastodynamics.