

IFWGP'07 | International Fall Workshop on Geometry and Physics

Speaker: José Merodio (Universidad Politécnica de Madrid)

Title: Ellipticity and discontinuous solutions in anisotropic finite elastostatics

Abstract:

In this talk we will review the loss of ellipticity condition of the nonlinear elastostatics governing differential equations that is associated to the so called material failure as opposed to the geometrical one or buckling. We will further examine this concept for some particular boundary value problems, among them, the rectilinear shear of fiber-reinforced incompressible non-linearly elastic solids. The loss of ellipticity condition determines locally both the deformation associated with the existence of surfaces of discontinuity and the direction of the normal to that surface. Surfaces of discontinuity are surfaces across which some of the variables involved in the governing differential equations (for instance, the displacement field or the second derivative of the deformation field) are discontinuous. In a local analysis, the onset of failure (the bifurcation giving rise to discontinuous solutions) is heralded by the loss of ellipticity of the governing differential equations. In a global analysis, the local ellipticity condition is insufficient as a test of the ellipticity status of a solution field corresponding to a specific boundary value problem. It is the existence of a suitable non-elliptic intermediate deformation that needs to be checked to analyze the solution. This will be shown for the problem at hand. Some comments on the application of this analysis (these ideas) to biomechanics where the constitutive equations are within the context of hyperelasticity will be given.