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Technische Universität Berlin
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Sekr. MS 2, Einsteinufer 5, 10587 Berlin

Ankündigung eines Gastvortrages

im Rahmen des Mechanik Seminars

zum Thema

ANALYTICAL MODELLING OF ANISOTROPIC MATERIALS WITH GRADIENTS IN ELASTIC PROPERTIES

Ort: **Technische Universität Berlin, Gebäude MS,**
Raum MS 107, Einsteinufer 5, 10587 Berlin
Mittwoch, 13. April 2011, 16:15 Uhr

Gastdozentin:

Frau Dr. Maria KASHTALYAN
Centre for Micro- and Nanomechanics (CEMINACS), University of Aberdeen, Scotland

Abstract:

The talk will present development of three-dimensional analytical solutions to some problems of solid mechanics for functionally graded materials (FGMs).

FGMs are advanced composite materials with properties that vary from one surface of the material to the other as a result of an intentionally introduced gradient in the composition of the material. Gradual variation of material properties is known to improve structural integrity and performance while preserving thermal, and/or structural benefits of constituent materials. The concept of graded material, initially developed for super heat resistant materials to be used in spacecraft or nuclear fusion reactors, is now actively explored in many other engineering applications, such as functional materials for energy conversion, dental and orthopaedic implants, sensors and thermogenerators, to name but a few. Advanced processing methods to introduce compositional gradients into various material systems are being developed by materials scientists.

Analysis of the mechanical behaviour of graded materials is associated with considerable mathematical difficulties, but if the material is also anisotropic, i.e. having properties that vary with direction, the analysis becomes even more challenging. It is well-known that the three-dimensional elasticity problem of equilibrium of a deformable solid requires in general the solution of a set of fifteen coupled partial differential equations. However it may be simplified significantly by introducing appropriately chosen displacement functions. While for homogenous solids many displacement functions exist, it is not the case for inhomogeneous solids – in particular, for an inhomogeneous transversely isotropic solid they were introduced only two years ago!

First, the talk will focus on how stresses and displacements in an inhomogeneous transversely isotropic solid, with constant Poisson's ratios and the same functional form of dependence of Young's and shear moduli on the co-ordinate normal to the plane of isotropy, can be represented in terms of two displacement functions. Then, it will be shown how this representation can be used to derive a three-dimensional elasticity solution for a transversely isotropic functionally graded plate. The combined effects on anisotropic and inhomogeneity on stress and displacement fields in the plate will be also examined and discussed.