

SECOND TALK

Coexistent Phase Mixtures in Anti-plane Shear

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Abstract

In 1928, Nakanishi noted that during yielding, while the average strain between the gauge marks on a body increases, the parts of the body, themselves, will yield in succession. He proposed that during this process the body would support a mixture of large and small strains and that the mixture would saturate at the large strain value when the yielding process was completed. Nakanishi was one of the first to recognize and study the now modern micromechanical viewpoint that coexistent fine phase structures are natural occurrences when bodies are subject to various types of large deformations.

This talk considers the question of minimization of energy for the anti-plane shear deformation of an isotropic elastic body whose stored energy function is non-convex. Attention is paid to the situation when a minimizing admissible deformation field does not exist but nevertheless the energy functional has an infimum. In this case, a minimizing sequence of admissible deformations can be identified which shows that when the energy is at its infimum the body is divided into three sub-domains; one of high strain, one of low strain, and one of intermediate “mixed” strain. The shape and location in the body of the intermediate “mixed” strain sub-domain is determined as part of the minimization procedure. The existence of such a sub-domain is associated with a softening of the overall load-deformation response of the body.

REFERENCE

Nakanishi, F., On the Yield Point of Mild Steel. J. Aeronautica Research Institute, University of Tokyo, v.46, 97-113 (1928).