TRANSACTIONS
of the
5th International Conference on
STRUCTURAL MECHANICS IN REACTOR TECHNOLOGY

Vol. L. Materials Modelling and Inelastic Analysis of Metal Structures

13-17 August 1979

STRUCTURAL MECHANICS IN REACTOR TECHNOLOGY

Vol. L. Materials Modeling and Inelastic Analysis of Metal Structures

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Published by

NORTH-HOLLAND PUBLISHING COMPANY — AMSTERDAM
NORTH-HOLLAND PUBLISHING COMPANY — OXFORD

for

THE COMMISSION OF THE EUROPEAN COMMUNITIES.
DIRECTORATE GENERAL SCIENTIFIC AND TECHNICAL
INFORMATION AND INFORMATION MANAGEMENT

Sole distributors for the U.S.A. and Canada:

ELSEVIER NORTH-HOLLAND INC.
52 Vanderbilt Avenue
New York, N.Y. 10017

North-Holland ISBN for this volume: 0444 85367 7
North-Holland ISBN for the set: 0444 85356 1

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COUPLING PHENOMENA IN THERMOPLASTICITY

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Abstract

The paper is restricted to a phenomenological theory of inelastic solid bodies with special regard to metals. The bodies are considered as classical continua underlying thermo-mechanical irreversible processes including solid phase transformations, recrystallization, recovery etc.

After some remarks on mechanical and thermodynamical foundations of such processes special emphasis is given to the general structure of the constitutive equations of plastic and visco-plastic materials. From these considerations some conclusions on coupling phenomena between mechanical, thermal, and internal processes are drawn. The coupling phenomena can be divided into two classes: the first kind of coupling phenomena appears already in homogeneous processes as, for instance, the interaction between hardening due to plastic deformations and softening caused by recrystallization and recovery, the second kind of coupling phenomena occurs only in non-homogeneous process like the generation of residual stresses in quenching.

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