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Mechanics Colloquium

Guest Speaker: Univ.-Prof. Dipl.-Math.techn. Dr.-Ing.
Thomas Hochrainer
Graz University of Technology
Date: 01.03.2024
Time: 10:30h
Location: 10.81 Emil Mosonyi-Hörsaal (HS 62)

Title: **Alignment and curvature tensors in dislocation theory**

Abstract

Plastic deformation of crystalline materials is the result of the motion and interaction of line-line crystal effects, the dislocations. Especially in face centred cubic crystals, dislocations form complex networks which display conspicuous patterns on mesoscopic scales. Continuum dislocation dynamics (CDD) seeks to model crystal plasticity as a statistical continuum theory of dislocations.

CDD is a continuum theory of moving oriented curves which was originally formulated on the higher-dimensional space of orientations of the dislocation lines. Since dislocation curvature plays an instrumental role for dislocation evolution, the fundamental object in CDD is a vector field on the unit sphere bundle. Therefore, the multipole expansion of CDD needs to be done by vector spherical harmonics. In the according tensor expansion there consequently occur two series of curvature tensors, besides the orientation tensors commonly used in other homogenized theories of fibres.

In the current talk I shall provide an overview of the tensorial continuum theory of dislocations, including the interpretation of the alignment and curvature tensors, conservation laws for the alignment tensors, as well as the determination of these tensors from curves discretized by straight segments. I shall conclude with a few thoughts on how the curvature tensors might be useful for developing constitutive models for fibrous materials with fibres exhibiting bending stiffness

REFERENCES

[1] T. Hochrainer, Multipole expansion of continuum dislocations dynamics in terms of alignment tensors. Philos. Mag. 95(12), 1321–1367 (2015).

[2] B. Weger, S. Gupta, T. Hochrainer, Analysing discrete dislocation data using alignment and curvature tensors. Compt. Rendus. Phys. (2021).

You are cordially invited to take part in the event!

Prof. Dr-Ing Thomas Böhlke