Fast Computations with Orientation Dependent Properties

Erik Wünsche*[1] and Ralf Hielscher[1]

[1]Technische Universität Bergakademie Freiberg – Germany

Abstract

Orientation dependent functions play an important role in modeling texture dependent properties. The most prominent example is of course the orientation distribution function (ODF). Other examples include the Taylor factor, the Schmid factor, the yield locus or wave velocities. Often these orientation dependencies are expensive to measure or to calculate.

In the first part of our talk we present a unified framework for the efficient representation of such orientation dependent functions. In particular, it allows to approximate a function from its values at only few orientations and to perform any type of operation with it. Our approach is based on the well known representation as a series of harmonic functions. The crucial point are fast algorithms for the evaluation of these series and carefully designed sets of orientations to switch between function values and harmonic coefficients.

In the second part we demonstrate the framework in action to significantly speed up the computation of transformation textures, strain induced texture evolution, or the grain boundary normal distribution. Most significantly, we will use our framework to model texture evolution by solving the continuity equation in Fourier domain.

Keywords: MTEX, Harmonic Approximation, Texture Evolution

*Speaker