IOF Leverage Project

Implementation of a software platform for multi-scale simulations of material forming processes (M2FORM)

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Description:
Over the past decades, K.U.Leuven has enjoyed a lot of scientific success with models for the plastic deformation of polycrystalline materials. Models have been developed at different levels of description, which are able to predict the evolution of the crystallographic texture and anisotropy during deformation. An accurate prediction of these microstructural features is critical for the successful design of metal forming operations. However, until now, using these texture models to dynamically update the microstructure during deformation was computationally too demanding to adopt in a industrial environment.

Recently, during an IDO project that involves the three applicants of the current leverage proposal, these models have been coupled into a hierarchical multi-scale model that allows for adaptive, local, on-demand updating of the texture and the associated constitutive behaviour during plastic forming. Consequently, computation times using a dynamically updated multi-scale model are now within acceptable limits (hours to a few days). Simultaneously, the effects of this adaptive updating on accuracy are being validated experimentally.

Motivated by this recent evolution, we are now convinced that the time is right to transfer the acquired scientific knowledge to industrial practice. The goal of this project is therefore to prepare the creation of a knowledge platform (KP) that can create and valorise a materials software suite with interfaces to finite-element analysis (FEA) software for the multi-scale simulation of industrial material forming processes. The adaptive updating method is very generic, so that the potential area of valorisation of the KP will be broad, and includes the evolutions of microstructures, voids and particle distributions and the respective effects on the properties of the material.