

# POLYCRYSTALS AND COMPUTATIONAL DESIGN: IS THE CONTROL OF MICROSTRUCTURE-SENSITIVE PROPERTIES FEASIBLE?

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The feasibility of control and design of the properties of a polycrystal will be explored through this effort. The development of a reduced order framework will be presented for texture classification as well as for modeling the evolution of texture during deformation processes. This involves the technique of proper orthogonal decomposition (POD) commonly used for the active control of fluid dynamical systems. It will be shown that POD representation of the orientation distribution function is an efficient technique for microstructure model reduction. Furthermore, we will introduce novel design/control problems for microstructure sensitive design based on realistic poly-crystalline plasticity. A gradient-based optimization framework will be presented based on a multi-length scale continuum sensitivity analysis. Numerical examples that highlight the efficient control of microstructure-sensitive properties through optimization of process stages and macro-design process parameters will be discussed. Finally, we will conclude with a summary of the major advantages of microstructural model reduction in computational deformation process design.