ACMS Applied Math Seminar

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154 Hurley Hall
3:30 PM – 4:30 PM

Grain Structure, Grain Growth and Evolution of the Grain Boundary Network

Cellular networks are ubiquitous in nature. Most technologically useful materials arise as polycrystalline microstructures, composed of a myriad of small monocrystalline cells or grains, separated by interfaces, or grain boundaries of crystallites with different lattice orientations. A central problem in materials science is to develop technologies capable of producing an arrangement of grains that provides for a desired set of material properties. One method by which the grain structure can be engineered is through grain growth (also termed coarsening) of a starting structure.

The evolution of grain boundaries and associated grain growth is a very complex multiscale process. It involves, for example, dynamics of grain boundaries, triple junctions, and the dynamics of lattice misorientations. Grain growth can be viewed as the evolution of a large metastable network, and can be mathematically modeled by a set of deterministic local evolution laws for the growth of an individual grain combined with stochastic models to describe the interaction between them. In this talk, we will discuss recent progress in mathematical modeling, simulation and analysis of the evolution of the grain boundary network in polycrystalline materials.