Threshold dynamics algorithms for curvature motion of networks of surfaces

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The Mullin's model proposed in the 50s for grain boundary motion tells us how the microstructure of polycrystalline materials evolve when they are heated up. According to the model, the interface (surfaces) in the material move according to gradient descent with respect to a weighted sum of the areas of the surfaces. As a result, the surfaces in the network move with normal speed proportional to the weighted mean curvature, while at triple junctions where three surfaces intersect a condition, known as the Herring angle condition, must be satisfied.

These dynamics can be simulated by a class of elegant and simple algorithms, known as threshold dynamics, which generate the desired interfacial motion just by alternating two very simple operations: Convolution, and thresholding. The original algorithm, proposed by Merriman, Bence, and Osher (MBO), works for networks where all surfaces have isotropic surface energies with equal weights. Recently, Esedoglu and Otto gave a variational interpretation of the original MBO algorithm. This allowed the algorithm to be extended to the case of unequal weights and anisotropic (normal dependent) surface energies. In this talk, I will report on this work and extensions therein.

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