ABSTRACT

"A convergent algorithm for the interaction of mean curvature flow and diffusion"

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In this talk we will present an evolving surface finite element algorithm for the interaction of forced mean curvature flow and a diffusion process on the surface.

The evolving surface finite element discretisation is analysed for the evolution of a closed two-dimensional surface governed by the above coupled geometric PDE system. The coupled system is inspired by the gradient flow of a coupled energy, we will use this model for introductory purposes.

We will present two algorithms, based on a system coupling the diffusion equation to evolution equations for geometric quantities in the velocity law for the surface.

For one of the numerical methods we will give some insights into the stability estimates which are used to prove optimal-order H^1-norm error estimates for finite elements of polynomial degree at least two. We will present numerical experiments illustrating the convergence behaviour and demonstrating the qualitative properties of the flow: loss of convexity, preservation of mean convexity, weak maximum principles, and the occurrence of self-intersections.

The talk is based on joint work with C. M. Elliott (Warwick) and H. Garcke (Regensburg).