Paolini, M.; **Verdi, C.**

Asymptotic and numerical analyses of the mean curvature flow with a space-dependent relaxation parameter. (English) Zbl 0757.65078

Asymptotic Anal. 5, No. 6, 553-574 (1992).

The asymptotic analysis developed in this paper guarantees that the following relaxed equation with a space-dependent relaxation parameter $\varepsilon a(x)\partial u_\varepsilon/\partial t = \varepsilon \mathrm{div}(a(x)\nabla_x u_\varepsilon) - \psi(u_\varepsilon)/(2\varepsilon a(x))$ in $\mathbb{R}^n \times (0,T)$, coupled with the initial condition $u_\varepsilon(.,0) = \chi_\varepsilon(.)$ in $\mathbb{R}^n$, approximates a flow by mean curvature, as $\varepsilon \to 0$.

It is shown that the zero-level surface of the relaxed solution approximates, with an error of order $O(\varepsilon^2)$, a surface evolving according to the mean curvature motion. The mean curvature evolution of the boundary of various 2D and axisymmetric 3D sets is simulated numerically. The numerous numerical experiments confirm the reliability of the asymptotic result.

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MSC:

65K10 Numerical optimization and variational techniques
49M15 Newton-type methods
49Q10 Optimization of shapes other than minimal surfaces

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mean curvature flow; finite element; local mesh refinement; motion by mean curvature; asymptotic analysis; space-dependent relaxation parameter; mean curvature evolution; numerical experiments