1116-35-1842 **Saulo Orizaga*** (sorizaga@math.arizona.edu), Tucson, AZ 85735, and **K. Glasner** (kglasner@math.arizona.edu). *Improving the accuracy of convexity splitting methods for gradient flow equations.*

This paper introduces numerical time discretization methods which significantly improve the accuracy of the convexity-splitting approach of Eyre (*Unconditionally gradient stable time marching the Cahn-Hilliard equation*, MRS Proceedings, vol. 529, 1998), while retaining the same numerical cost and stability properties.

A first order method is constructed by iteration of a semi-implicit method based upon decomposing the energy into convex and concave parts. A second order method is also presented based on backwards differentiation formulas. Several extrapolation procedures for iteration initialization are proposed. We show that, under broad circumstances, these methods have an energy decreasing property, leading to good numerical stability.

The new schemes are tested using two evolution equations commonly used in materials science: the Cahn-Hilliard equation and the phase field crystal equation. We find that our methods can increase accuracy by many orders of magnitude in comparison to the original convexity-splitting algorithm. In addition, the optimal methods require little or no iteration, making their computation cost similar to the original algorithm. (Received September 21, 2015)