

**Title: Best approximation error estimates for discontinuous Galerkin time-stepping schemes for the Allen-Cahn equation**

Konstantinos Chrysafinos  
*Department of Mathematics*  
*National Technical University of Athens*  
*email:chrysafinos@math.ntua.gr*

**Abstract:**

We consider fully-discrete schemes for the Allen-Cahn equation based on a discontinuous Galerkin (in time) approach, and we prove that these schemes are unconditionally stable under minimal regularity assumptions on the given data. Best-approximation a-priori error estimates of arbitrary order are presented in the natural energy norms by using an appropriate duality argument, combined with a boot-strap technique. Great care is exercised in order to quantify the dependence upon  $\epsilon$  of various constants appearing in these estimates. In particular, the polynomial dependence upon  $1/\epsilon$  is demonstrated in the natural energy norms.