# DOUBLY NON-LOCAL CAHN HILLIARD EQUATION WITH FRACTIONAL TIME DERIVATIVE

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ABSTRACT. We consider a doubly nonlocal Cahn-Hilliard equation (dnCHE) which describes phase separation of a binary system, but replace the classical time derivative with a Caputo fractional time derivative. In doing so, this modification can be used to model dynamic processes in which particles are thought to have some 'memory'. We establish both the existence and uniqueness of a solution to this modified equation. Then, using a combination of a forward Euler scheme and a convolution quadrature rule we numerically approximate our mild solution. We establish convergence of mild solutions to that of the mild solution of the dnCHE when the order of the fractional derivative approaches 1.