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A NUMERICAL STABILITY ANALYSIS OF CHEMO-MECHANICAL FORMULATIONS OF BIOLOGICAL GROWTH

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ABSTRACT

We consider the stability of the coupled chemo-mechanical formulation for biological growth based upon our recent work [1,2]. For this nonlinear chemo-mechanical problem a meaningful notion of stability must first be defined, which we do by taking recourse to the thermodyanics of growth. A condition of decreasing free energy is first sought for the exact (continuous) problem. We then seek to extend to this notion of stability to standard algorithms used for the coupled problem. Specifically, we invoke operator-splitting methodologies and aim to analyze the stability engendered by a few commonly-used constitutive models of growth. In a departure from standard literature, the focus here will be on the chemistry that drives growth, rather than traditional mechanical stability analyses.

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