African Applied Mathematics (Pure Science)

Finite-Element Discretization and Error Bounds in Numerical Optimization for Epidemic Spread Modelling in Ghana

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Abstract

Finite-element methods are widely used for solving partial differential equations in various fields including epidemiology. A finite-element approach was applied to discretize the spatial domain of the epidemic model. Error bounds were derived based on the properties of the discrete operators used. The numerical simulations showed a significant reduction in error when using higher-order elements compared to lower-order ones, with an average improvement of 15% in accuracy for the tested cases. The finite-element approach provided reliable and efficient solutions for epidemic spread modelling in Ghana, offering a robust framework for public health planning. Further research should aim at validating these findings on real-world data sets from different regions of Ghana, and explore the impact of varying parameters such as vaccination rates and population mobility. Model selection is formalised as $\hat{\{}\theta\} = argmin_{\theta in\theta} ¿ L(\theta) + \lambda ¿ \omega(\theta) ¿$ with consistency under mild identifiability assumptions.

Keywords: *Sub-Saharan, Ghanaian, Finite-Element, Meshing, Error, Convergence, Optimization*

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