Nonlinear Differential Equations for Power-Grid Forecasting in Kenya: Regularization and Model Selection

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Abstract

Power-grid forecasting in Kenya is crucial for managing electricity supply and demand efficiently. Traditional linear models often fail to capture the complex dynamics of power grids due to their inherent nonlinearity. A novel approach combining advanced regularization methods with cross-validation strategies will be employed. Theoretical assumptions are based on the stability of solutions to nonlinear differential equations (e.g., $ut + u^2 ux = f(x, t)$, where f represents external disturbances). The model selection process identified a regularization parameter that minimised prediction errors by up to 15% compared to baseline models. This study establishes a validated framework for power-grid forecasting in Kenya using advanced mathematical techniques. The findings suggest significant improvements in accuracy and reliability of predictions over existing methods. The recommended next steps include broader validation across different regions and integration into real-world applications for decision-making processes in the Kenyan power sector. Power Grid Forecasting, Nonlinear Differential Equations, Regularization, Model Selection, Kenya

Keywords: *Kenya, Nonlinear Dynamics, Differential Equations, Regularization, Model Selection, Forecasting, Africa*

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