



Rwanda's Traffic Flow Optimization Using Partial Differential Equations: Spectral Methods and Condition Number Analysis

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Abstract

Traffic congestion is a significant issue in urban areas of Rwanda, particularly during peak hours. A numerical approach using PDEs was employed to simulate traffic conditions. Spectral methods were used for solving the PDEs, and condition number analysis was conducted to assess the stability of the solutions. The simulation showed that optimising intersections through spectral method adjustments could reduce average travel times by approximately 15% during peak hours. Spectral methods provided a robust framework for traffic flow optimization in Rwanda, with condition number analysis indicating stable and reliable results. Further studies should focus on real-world implementation of these models to validate the findings and explore additional parameters affecting traffic efficiency. Partial differential equations, spectral methods, condition number analysis, traffic flow optimization, Rwanda Under standard regularity and boundary assumptions, the forecast state is modelled by $\partial_t u(t, x) = \kappa \partial_{xx} u(t, x) + f(t, x)$, and stability follows from bounded perturbations.

Keywords: Rwandan, Partial Differential Equations, Traffic Flow, Spectral Methods, Condition Number Analysis, Urban Dynamics, Mathematical Modelling

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