African Topology Studies (Pure Science)

Spectral Methods and Condition Number Analysis for Partial Differential Equations in Water-Resource Allocation in Ghana: An African Perspective

Bright Ofori Mensah[1]

[1] Ghana Institute of Management and Public Administration (GIMPA)

Published: 05 December 2011 | **Received:** 10 July 2011 | **Accepted:** 28 October 2011

Correspondence: bmensah@aol.com

DOI: 10.5281/zenodo.18928527

Author notes

Bright Ofori Mensah is affiliated with Ghana Institute of Management and Public Administration (GIMPA) and focuses on Mathematics research in Africa.

Abstract

Spectral methods are advanced numerical techniques used to solve partial differential equations (PDEs), which are fundamental in modelling water-resource allocation processes such as river flow and groundwater distribution in Ghana. Spectral methods utilise orthogonal polynomial bases to approximate solutions to PDEs. Condition number analysis evaluates the sensitivity of the solution to perturbations in input data, ensuring reliable predictions in complex environmental systems. A key finding is that spectral methods can significantly reduce computational time compared to traditional finite difference or finite element methods for solving water-resource allocation models. Spectral methods offer a robust framework for accurately modelling and predicting water resources under varying conditions, with condition number analysis providing critical insights into the reliability of these models. Further research should explore integrating spectral methods with machine learning algorithms to enhance predictive accuracy in dynamic water resource systems. Partial Differential Equations, Spectral Methods, Condition Number Analysis, Water Resource Allocation, Ghana Under standard regularity and boundary assumptions, the forecast state is modelled by $partialt\,u(t,x)=\kappa ¿\partial\{xx\}u(t,x)+f(t,x)$, and stability follows from bounded perturbations.

Keywords: *African, Ghana, Spectral Methods, Partial Differential Equations, Condition Number Analysis, Numerical Techniques, Mathematical Modelling*

ABSTRACT-ONLY PUBLICATION

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

✉ REQUEST FULL PAPER

Email: info@parj.africa

Request your copy of the full paper today!

SUBMIT YOUR RESEARCH

Are you a researcher in Africa? We welcome your submissions!

Join our community of African scholars and share your groundbreaking work.

Submit at: app.parj.africa

Scan to visit app.parj.africa

Open Access Scholarship from PARJ

Empowering African Research | Advancing Global Knowledge