Spectral Methods and Condition-Number Analysis in Stochastic Power-Grid Forecasting for Senegal: A Theoretical Framework

Mahamadi Diop[1,2]**, Sarra Ndaw**[3,4]**, Salif Sow**[2]

[1] African Institute for Mathematical Sciences (AIMS) Senegal

[2] Cheikh Anta Diop University (UCAD), Dakar

[3] Université Gaston Berger (UGB), Saint-Louis

[4] Department of Research, African Institute for Mathematical Sciences (AIMS) Senegal

Author notes

Mahamadi Diop is affiliated with African Institute for Mathematical Sciences (AIMS) Senegal and focuses on Mathematics research in Africa.

Sarra Ndaw is affiliated with Université Gaston Berger (UGB), Saint-Louis and focuses on Mathematics research in Africa.

Salif Sow is affiliated with Cheikh Anta Diop University (UCAD), Dakar and focuses on Mathematics research in Africa.

Abstract

This article explores stochastic power-grid forecasting in Senegal, focusing on spectral methods and condition-number analysis to enhance predictive accuracy. Spectral decomposition of the system matrix will be employed, alongside rigorous condition-number analysis to ensure stability and reliability of forecasts. Theoretical derivations and proofs are based on assumptions about grid topology and load distribution. This theoretical framework provides a robust foundation for integrating stochastic processes into power-grid forecasting models, offering practical benefits through enhanced predictive performance and operational efficiency. Practical implementation should consider specific grid characteristics and integrate these insights with existing data to ensure model relevance and applicability in real-world scenarios. The analytical core is $\hat{\{y\}}t = mathcal\{F\}(xt;\theta)$ with $\hat{\{\theta\}} = argmin_\theta L(\theta)$, and convergence is established under standard smoothness conditions.

Keywords: *Sub-Saharan, Stochastic, Spectral, Decomposition, Conditioning, Power Grid, Networks*

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