2 June 2025 ·
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Peer Review

Review of: "Topolectrical Circuits – Recent Experimental Advances and Developments"

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I have made a summary of "Topolectrical circuits - Recent experimental advances and developments" and detailed it below pointwise.

1. Theoretical Foundations and Circuit Analysis

Laplacian Formalism: This section explores how the Laplacian matrix is used to analyse electrical circuits, drawing analogies with Hamiltonians in condensed matter systems. The approach is central to understanding the impedance behaviour and topological traits of topolectrical circuits (TECs).

Impedance-Based Spectroscopy: The authors describe techniques for extracting the Laplacian spectrum from impedance measurements, enabling the direct experimental identification of topological modes in circuit configurations.

2. Progress in Non-Hermitian Circuit Realisations

Exceptional Points (EPs): The article details experimental realisations of EPs within parity-time (PT) symmetric circuits. These setups reveal robust resonant behaviours linked to non-Hermitian degeneracies.

Non-Hermitian Skin Effect (NHSE): Demonstrations of NHSE are reviewed across both 1D and higher-dimensional TECs, showcasing unconventional localisation effects caused by asymmetric coupling.

3. Investigating Nonlinear Dynamics in Circuits

Nonlinear Oscillators: The incorporation of elements such as van der Pol oscillators into TECs is discussed, leading to phenomena like boundary-localised self-oscillations and nonlinearity-driven topological phase transitions.

doi.org/10.32388/02CW2J

Higher Harmonics and Soliton Dynamics: The study investigates how nonlinearity enables the emergence of higher harmonics and soliton-like excitations, underscoring rich interactions between topological and nonlinear effects.

Non-Hermitian Sensing Applications: Some experiments reviewed point toward the practical use of non-Hermitian circuit properties in highly sensitive electronic sensing applications.

4. Circuit-Based Realisations of Condensed Matter Phenomena

Nonlinear Topological Effects: This section highlights circuit implementations that manifest nonlinear topological behaviour by arranging nonlinear elements in topologically nontrivial configurations.

Floquet Topological Phases: Using high-frequency temporal modulation, TECs are shown to emulate Floquet systems, opening pathways to investigate time-periodic topological phases in real time.

Hyperbolic Lattice Realisations: The article also presents circuit models that replicate hyperbolic lattices, offering a platform to study geometrically exotic lattice structures.

Quantum and Topological System Simulations: Several experimental setups are reviewed that successfully simulate complex quantum or topological models, particularly those difficult to realise in other physical systems.

5. Machine Learning in Circuit Engineering

Predictive and Inverse Design: Machine learning techniques are applied to model circuit behaviour, predict responses, and automate the design process to achieve targeted topological functionalities.

6. Outlook and Emerging Directions

Future Phenomena and Applications: The review anticipates the exploration of advanced topological effects, such as flat bands, quantum valley Hall states, and non-Abelian modes. It also emphasises practical applications in areas like high-precision sensing, signal processing, and next-generation topological electronics.

Thus, I suggest the publication of the review article on Qeios. However, please note that this article has already been published as a review article in APL Electronics.

Declarations

Potential competing interests: No potential competing interests to declare.