Exotic phases in non-Hermitian extended SSH models

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We explore the effects of non-reciprocal hopping in the extended Su-Schrieffer-Heeger (SSH) models, considering four sub-lattices in a unit cell and second-nearest-neighbor intercell hopping for SSH4 and SSH long-range (SSHLR) models, respectively [1]. We first study the bulk-boundary correspondence of the non-Hermitian topological phase by comparing the open boundary end modes and bulk invariant computed in a generalized Brillouin zone. Interestingly, the bulk-boundary correspondence is restored for the SSH4 while there exist challenges in SSHLR model, caused by the multi-valuedness of the non-Bloch momentum in generalized Brillouin zone for the next-nearest neighbor coupling. Furthermore, winding numbers obtained from different off-diagonal blocks of the Hamiltonian can differ, revealing a richer and more intricate topological structure only for the SSHLR model. Thereafter, we extend the concept of charge transport in the NH models under adiabatic driving where quantized nature of charge transport can be understood from the non-Bloch Chern number and non-Hermtian Bott index. The adiabatic evolution of zero-modes can be explained by the bulk-boundary correspondence which is substantailly richer in SSHLR model than that of the SSH4 model. Our study sheds light on the non-Hermiticity mediated topological phases in static as well as driven extended SSH models [2].

- [1] D. Joshi, T. Nag, arXiv:2503.18125.
- [2] D. Joshi and T. Nag under preparation (2025).