

# Spectral flow for real skew-adjoint Fredholm operators

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**Abstract:** An analytic definition of a  $\mathbb{Z}_2$ -valued spectral flow for paths of real skew-adjoint Fredholm operators is given. It counts the parity of the number of changes in the orientation of the eigenfunctions at eigenvalue crossings through 0 along the path.

The  $\mathbb{Z}_2$ -valued spectral flow is shown to satisfy a concatenation property and homotopy invariance, and it provides an isomorphism on the fundamental group of the real skew-adjoint Fredholm operators. Moreover, it is connected to a  $\mathbb{Z}_2$ -index pairing for suitable paths. Applications concern the zero energy bound states at defects in a Majorana chain and a spectral flow interpretation for the  $\mathbb{Z}_2$ -polarization in these models.

Joint work with A. L. Carey and J. Phillips