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Systematic Construction of tight-binding Hamiltonians for Topological Insulators and Superconductors[1] DONG-LING DENG, SHENG-TAO WANG, LU-MING DUAN, Department of Physics, University of Michigan, Ann Arbor, Michigan 48109, USA — A remarkable discovery in recent years is that there exist various kinds of topological insulators and superconductors characterized by a periodic table according to the system symmetry and dimensionality. To physically realize these peculiar phases and study their properties, a critical step is to construct experimentally relevant Hamiltonians which support these topological phases. We propose a general and systematic method based on the quaternion algebra to construct the tight binding Hamiltonians for all the three-dimensional topological phases in the periodic table characterized by arbitrary integer topological invariants, which include the spin-singlet and the spin-triplet topological superconductors, the Hopf and the chiral topological insulators as particular examples. For each class, we calculate the corresponding topological invariants through both geometric analysis and numerical simulation.

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