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LATTICE SYSTEM OF TWO FERMIONS WITH FIRST AND SECOND NEAREST-NEIGHBORING-SITE INTERACTIONS

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A system of two identical spinless fermions on the two-dimensional lattice is studied under the assumption that the first and second nearest-neighboring-site interactions between the fermions are only nontrivial and that these interactions are of magnitudes λ and μ, respectively. A partition of the (λ, μ) plane is established such that, in each its connected component, the two-fermion Schrödinger operator corresponding to the zero quasi-momentum of the center of mass has definite (fixed) numbers of eigenvalues that are located below the bottom of the essential spectrum and above its top. Furthermore, for each connected component, a sharp lower bound is established on the number of isolated eigenvalues for the two-fermion Schrödinger operator corresponding to any admissible nonzero value of the center-of-mass quasimomentum. The results obtained help one to clarify the mechanism of emergence of eigenvalues of a two-fermion lattice Schrödinger operator from the essential spectrum as λ and μ vary as well as to understand the inverse process, the absorption of eigenvalues by the essential spectrum.