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An Exactly Solvable Many-Body Model NOUREDINE ZETTILI, Department of Physical and Earth Sciences, Jacksonville State University, Jacksonville, AL 36265, ABDELKRIM BOUKAHIL, Physics Department, University of Wisconsin-Whitewater, Whitewater, WI 53190 — We deal here with the construction of a simple many-body model that can be solved exactly. This model serves as a tool for testing the validity and accuracy of many-body approximation methods, most notably those encountered in nuclear theory. The model consists of a system of two distinguishable, one-dimensional sets fermions interacting via a schematic two-body force. We construct the Hamiltonian of the model by means of vector operators that satisfy a Lie algebra and which are the generators of an SO(2,1) group. The Hamiltonian depends on an adjustable parameter which regulates the strength of the two-body interaction. The size of the Hamiltonian's matrix is rendered finite by means of a built-in symmetry: the Hamiltonian is represented by a five-diagonal square matrix of finite size. The energy spectrum of the model is obtained by diagonalizing this matrix. The energy eigenvalues obtained from this diagonalization are exact, for we don't need to resort to any approximation in the diagonalization. This model offers a rich and flexible platform for testing quantitatively the various many-body approximation methods especially those that deal with nuclear collective motion.

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