Explicit matrix representations of several discrete symmetry operators on multiband transfer matrices are given for solving electronic and propagation problems in quasi-2D semiconductor structures. We show that the Time Reversal and Coordinates Inversion symmetries together with Flux Conservation Principle, lead to constraints over the different types of transfer matrices and simplify the computing of physical quantities relevant for QW’s, MQW’s and SL’s. Any Envelope Function Approximation (EFA) model is expected to have the same or similar identities with minor changes. Based on the Transfer Matrix definitions, and with the main purpose of studying transport properties, through square potentials regions, for quasi-2D systems described within the EFA model, we establish the relation between the transfer matrices of the first kind, usual in the current solid state physics theory, and the transfer matrix of the second kind, more frequently used in the scattering approach. In this paper we also deduce new symmetry requirements for the transfer matrix of the first kind $M_{fd}$ for a multiband case of current interest in quantum-transport problem: the $(4 \times 4)$ Kohn-Luttinger (KL) Hamiltonian. Illustrating this model, we made clear that the $(2 \times 2)$ sub-spaces demand attention to avoid erroneous statements. By considering separately the “up” and “low” KL Hamiltonians, we have demonstrated that they do not preserve the time reversal invariance, for nonzero in-plane wavevector. The absence of definite parity, of the $(2 \times 2)$ quasi-particles states, away from the Brillouin Zone center have been derived. Instead, they transform one into another as follows from the deduced expressions. However it has been shown that, when approaching to this singular $\Gamma$ point, the $(2 \times 2)$ sub-systems continuously and fully recover these symmetries as expected. Besides the basic interest of this topic, we expect that the new representations will be useful and convenient in controlling bothersome numerical calculations, as well as in studying the relevant quantities in the multichannel-multiband tunnelling. Expressions we have obtained are also being numerically verified within the computer uncertainty.

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