Ballistic electron transport described by a fourth order Schrödinger equation

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A fourth order Schrödinger equation for the description of charge transport in semiconductors in the ballistic regime is proposed with the inclusion of non parabolic effects in the dispersion relation in order to go beyond the simple effective mass approximation. Similarly to the standard (second order) Schrödinger equation, the problem is reduced to a finite spatial domain with appropriate transparent boundary conditions to simulate charge transport in a quantum coupler [1, 2, 3], where an active region representing an electron device is coupled to leads which take the role of reservoirs. Some analytical properties are investigated and a generalized formula for the current is obtained. Numerical results show the main features of the solutions of the new model. In particular, an effect of interference appears due to a richer wave structure than that arising for the second order Schrödinger equation in the effective mass approximation. The results are based on the paper [4].

References

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