Dynamical approach to chains of scatterers

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Abstract

The linear chains of quantum scatterers have been in the past, [1, 2, 3, 4], and still remain an interesting subject of study as they can model almost macroscopic structures of linear topology. Especially work on disordered chains have left a strong mark on understanding of quantum mechanical systems [5, 6, 7]. Here we made an attempt to understand this chains using a more dynamical approach namely studying the dynamical system representing lengthening of the chain. The analysis is performed in the scattering matrix formalism [8], where we limit ourselves to unitary scattering matrices. The main interest was to understand the long-length behavior of the chain's scattering matrix. We divide the analysis into one and higher dimensional case of scatterers composing the chain, where the previous can be dealt totally analytically. In one-dimensional case we review and shed some new light on the transport propertie s of disordered and noisy chains. A more detailed analysis is presented for the case of periodic chains, where simple dynamical properties and condition for zero-transmission of the chain are found. In chains composed of higher-dimensional scatterers we discuss general transport properties focusing on scattering matrices that produce zero-transmission chains.

References

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