FINITE PSEUDO ORBIT EXPANSIONS FOR SPECTRAL QUANTITIES OF QUANTUM GRAPHS

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We investigate spectral quantities of quantum graphs by expanding them as sums over pseudo orbits, sets of periodic orbits. Only a finite collection of pseudo orbits which are irreducible and where the total number of bonds is less than or equal to the number of bonds of the graph appears, analogous to a cut off at half the Heisenberg time. The calculation simplifies previous approaches to pseudo orbit expansions on graphs. We formulate coefficients of the characteristic polynomial and derive a secular equation in terms of the irreducible pseudo orbits. From the secular equation, whose roots provide the graph spectrum, the zeta function is derived using the argument principle. The spectral zeta function enables quantities, such as the spectral determinant and vacuum energy, to be obtained directly as finite expansions over the set of short irreducible pseudo orbits.

Keywords: Quantum graphs, Pseudo orbits, vacuum energy, spectral determinant