Contributed Session 8: Abstract dynamical systems

Nonlinear Electron and Hole Dynamics in Semiconductor Superlattices

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In the study of semiconductor superlattices we strongly suggest that hole resonant tunneling processes must be involved. So far, the nonlinearity in the superlattice was only concerned with the transport of electrons and the transport of holes was almost completely neglected. We generalize the formalism developed in electrons transport to include holes transport. This generalized form of the electron and hole transport theory was applied in discussing the charge dynamics in AlAs/GaAs semiconductor superlattices which consists of alternating layers of two different materials with different band gaps.

Application of external dc voltage, perpendicular to the quantum well layers, gave rise to a vertical electron and hole current in AlAs/GaAs semiconductor superlattices. We use the simplest possible approach to include the electrons and holes in the charge dynamics and see what happens. We formulated the basic charge dynamic equations in semiconductor superlattices which include the electrons and holes. In conclusion, we have presented a model for the vertical transport of electrons and holes in the AlAs/GaAs semiconductor superlattices, using the sequential resonant tunneling model and Fermi's Golden Rule. Our results provide the first evidence of both the electrons and the holes transport in semiconductor superlattices

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The positive entropy kernel for some families of tree maps.

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We study some aspects of the arithmetics of the set of periods of some tree maps with zero topological entropy. Specifically we compute, in terms of the topology of the tree on which the map is defined, upper bounds for the number of *gods* ("greater odd divisor") of the set of periods. In 1991, Llibre and Misiurewicz defined the notion of *god* and proved that for any graph G there is an integer N_G such that each continuous map on G whose set of periods has more than N_G gods has positive topological entropy. The authors gave a generic formula for an upper bound of N_G. In the case of tree maps, this bound was refined in the work of Block (1992). We compute the exact value of N_G for maps defined on some families of trees: n-stars, n-combs and $(n_1,\ldots,n_k)$-stars.

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Fixed Points and Complete Lattices

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Tarski proved in the 1955 that every complete lattice has the fixed point property. Later, Davis proved the converse that every lattice with the fixed point property is complete. For a chain complete ordered set, there is the well known Abian-Brown fixed point result. As a consequence of the Abian-Brown result, every chain complete ordered set with a smallest element has the fixed point property. In this paper, new characterizations of complete lattices are given. Also, fixed point theorems are given for decreasing functions where the partially ordered set need not be dense as is the usual case for fixed point results for decreasing functions.

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A class of discrete spectral systems using Hilbert spaces

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Abstract : The concept of left invertibility is generalized for linear abstract systems with unbounded state operators in infinite dimensional Hilbert spaces. Criterion for left invertibility provided in this context generalize the main known result in finite dimensional spaces. For l invertibility of a class of discrete spectral systems, various results are obtained under certain conditions. Key words : Invertibility; Discrete spectral systems; Invariant zero; Frequency invariance

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On the star-shaped condition on Ding's version of the Poincaré-Birkhoff theorem

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The Ding's version of the well known Poincaré-Birkhoff theorem states that if an area-preserving homeomorphism: i) rotates the inner boundary C_1 and the outer boundary C_2 of an annular region in opposite directions, ii) there is an area-preserving extension to the open region bounded by C_1, iii) the origin is in the image of the open region bounded by C_1, iv) C_1 is star-shaped, then there are at least two fixed points.

Since this version of the Poincaré-Birkhoff is more suitable for applications it was widely applied.

While the first conditions are clearly necessary, the star-shaped condition seems to be a technical condition. We will see if this condition is really necessary.

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