

## **ABSTRACT**

**THESIS:** Electrical Properties of Carbon Structures: Carbon Nanotubes and Graphene Nanoribbons

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Graphene is a one-atom thick sheet of graphite which made of carbon atoms arranged in a hexagonal lattice. Carbon nanotubes and graphene nanoribbons can be viewed as single molecules in nanometer scale. Carbon nanotubes are usually labeled in terms of the chiral vectors which are also the directions that graphene sheets are rolled up. Due to their small scale and special structures, carbon nanotubes present interesting electrical, optical, mechanical, thermal, and toxic properties. Graphene nanoribbons can be viewed as strips cut from infinite graphene. Graphene nanoribbons can be either metallic or semiconducting depending on their edge structures. These are robust materials with excellent electrical conduction properties and have the potential for device applications. In this research project, we present a theoretical study of electrical properties of the carbon structures. Electronic band structures, density of states, and

conductance are calculated. The theoretical models include a tight-binding model, a Green's function methodology, and the Landauer formalism. We have investigated the effects of vacancy and weak disorder on the conductance of zigzag carbon nanoribbons. The resulting local density of states (LDOS) and conductance bands show that electron transport has interesting behavior in the presence of any disorder. In general, the presence of any disorder in the GNRs causes a decrease in conductance. In the presence of a vacancy at the edge site, a maximum decrease in conductance has been observed which is due to the presence of quasi-localized states.