NANO TECHNOLOGY: MOLECULAR ELECTRONICS AND NANO ELECTRONIC FOR QUANTUM COMPUTERS

Mentor: Dr. Brij N. Singh, Assistant Professor
228 Stanley Thomas Hall
Department of Electrical Engineering and Computer Science
(504) 862-3376
E-mail: singh@eecs.tulane.edu

Description:

Primary direction of progress of 'information technology' has been towards miniaturization of devices, increased speed and reduced power consumption. To a certain degree these features are interconnected, in general, larger the size, slower the speed, and higher the power consumption. The trend of advancement of solid-state circuits is forcing the device level measurements at nano meter scale, where keeping the basic switching property of the device becomes difficult. The direction of this research is to find alternate device options, which will show similar switching property of solid-state devices at smaller scale with higher speed and lesser power dissipation.

Computer size and processor size has been shrinking ever since the invention of transistors at bell labs. The progress of the information technology has been attributed by shrinking size of solid-state transistors and processors and consumer electronic chips made up of those transistors. For long despite of various negative and positive predictions moore's law has been able to predict successfully the advancement of information technology.

Knowledge derived from the fields of MEMS and LCD predicted the possibility of computational devices made up of molecules at nano meter scale. At this time, when computational electronics is facing the hardest challenge to maintain the speed of advancement, people are putting more intense effort is to find alternative devices for computation. This includes sensors, actuators and switching devices. Solid-state devices have hit the rock bottom of miniaturization. To meet the demand of speed and low power, alternatives to solid semi conductors have to be searched in the range of nano meter scale feature size. Nano technology is already a proven technology for LCD but it is yet to prove its worth for computational applications. The ultimate objective of computational industry is quantum computing, which is very immature at this stage, molecular electronics is the next step in miniaturization after MEMS and substitute of MEMS in some cases until quantum computing takes over.

Nano technology has been used widely in liquid crystal display (LCD), but now nano technology is being seriously considered for replacing current technology in mechanical, electrical and computational industry. In the computational and related industries, widely

used devices are light emitting diodes (LED), organic light emitting diode (OLED), Diodes, field effect transistors (FET), bipolar junction transistors (BJT). Diodes, BJTs and FETs have generic characteristic. This characteristic is to influence the amplitude of either current or voltage in one terminal by controlling the voltage or current in other terminal. This characteristic can be approximated to switching or amplification characteristic by imposing the device under suitable conditions. Development of molecular nano electronics using non solid-state semi conductors depends on finding molecular devices, whose characteristics can be approximated to the switching and amplification property by imposing suitable conditions on the molecule.

The proposed project will provide student a great deal of opportunity to work on a project involving lots of exciting aspects of nanotechnology.

Objective: To provide an exciting opportunity to student to work in frontier area of nano technology and its numerous applications including quantum computers.

Prerequisites:

None