Summer Internships 2013
List of Projects

Project Code: SIMR01
Title: A simulation study of magnetic edge-driven computational device.
Supervisor: Prof. Madhav Rao
Brief Description: The ability to pattern devices at nano-scale leads to the realization of novel computational devices, an alternate to CMOS technology. One such class of devices is edge-driven computational devices. In general it consists of planar array of data processing cells. The computation is triggered by modifying a bi-stable physical property of cells on one edge of the array of the system. The two physical states are used to encode the logical states of the computational input. While the input cells are held in their initial logical states, the remainder of the array is driven to the global minimum energy ground state. Each non-input cell changes its state based upon the influence of neighboring cells. After reaching the ground state, the physical states of cells on the far edge of the device are logically interpreted as the output of the computation. The exact question answered by the computation depends on the the pattern of dots within the array. The edge triggered computational device will be realized by using magnetic dots. The desired computation is performed by the polarity interaction between the ferromagnetic magnetic dots. The simulation study via *OOMMF*, an open source software, will provide an insight to fabricate the nanomagnets of desired size and shape.

The students having strong background in electromagnetism and interested to work in nanoelectronics area may wish to apply. The intern student will be working extensively with the open source software *OOMMF*. The micromagnetic tool details can be found in the given link (*http://math.nist.gov/oommf/*).

Project Code: SIMR02
Title: Algorithmic design of solder based self assembled posts for 3-D chip integration.
Supervisor: Prof. Madhav Rao
Brief Description: Three dimensional (3-D) integration offers several advantages over conventional very large scale integrated (VLSI) circuits, including reduced signal delay and power, as well as increased design flexibility. 3-D integration is viewed as a system level architecture where multiple layers of planar devices are stacked via solder bumps on copper posts, thereby leaving space for coolant fluid to flow acorss the hybrid stack. On the similar lines, an innovative, robust and parallel process technique known as solder based self assembled (SBSA) 3-D posts was fabricated for 3-D ICs. The SBSA follows the geometric principles that underlie self-folding of micro- and nano-scale polyhedra from 2-D nets. The aim of the summer research is to simulate optimal shape and dimensions of the 3-D structures from all possible 2-D nets using an open source simulation tool *Surface Evolver*. The simulation tool details can be found in the given link (*http://www.susqu.edu/brakke/evolver/evolver.html*).

Project Code: SIMR03
Title: Analysis of Cu/CNT based 3-D TSV for emerging RF applications.
Supervisor: Prof. Madhav Rao
Brief Description: Currently scientists have analyzed Copper based 3-D Through Silicon Vias (TSV) for emerging 60 GHz applications such as military communications, high frequency acoustics and other higher end wireless applications. However Carbon nanotubes (CNTs) is an emerging alternative to copper interconnects due to high electrical and thermal conductivity. Although CNT bundles shows better properties, poor volume fraction within CNT bundles needs to be compensated. Copper reverse electroplating is a standard method to fill the TSVs and hence copper matrix inside CNT bundles fills the porosity. An integrated model (CNT/Cu matrix) needs to be developed by incorporating quantum confinement effects of CNTs. Substrate parasitics needs to be integrated within the model. The student is supposed to develop an integrated model of CNT/Cu TSV model using HSPICE in the summer.

Project Code: SINS01
Title: Classification between normal and abnormal subjects using resting fMRI scans.
Supervisor: Prof. Neelam Sinha
Brief Description: "Resting" state fMRI scans are known to be useful in determining the neurological status of a person.In this project, the student is expected to utilize machine learning concepts of feature selection and classification to distinguish between normal and abnormal subjects.
The students applying for this project should having some background in basics of pattern recognition.

Project Code: SINS02
Title: Compressed sensing in MR Imaging.
Supervisor: Prof. Neelam Sinha
Brief Description: Compressed sensing is being extensively explored for MR imaging, since it allows image reconstruction with sub-Nyquist rate data sampling. In this project the student is expected to explore issues in image reconstruction, for a given imaging scenario, such as brain imaging.
The students applying for this project should having some background in digital signal processing.

Project Code: SIPP01
Title: Understanding twisted radio wave propagation to build better receivers.
Supervisor: Prof. P G Poonacha
Brief Description: Twisted radio waves help in increasing the capacity of communication channels by the use of multiple transmit and multiple receive antennas. In this project interested student will understand different approaches used by researchers in this area and implement a scheme to transmit and receive twisted radio waves with frequency modulation.

Project Code: SIPP02
Title: Health monitoring by image processing using a laptop or a mobile phone.
Supervisor: Prof. P G Poonacha
Brief Description: There is a great need for health monitoring by looking at a person and talking to a person. In this project interested student will understand different techniques used by people to monitor health of a person using images.

Project Code: SIPP03
Title: Study and implementation(simulation) of protocols for mobile adhoc networks.
Supervisor: Prof. P G Poonacha
Brief Description: Time critical protocols for Mobile adhoc networks can provide efficient data communication links and find use in wireless sensor networks. Interested student is expected to create a simulation test bed for testing protocols for performance.

Project Code: SIPP04
Title: Music instrument recognition using fuzzy logic techniques.
Supervisor: Prof. P G Poonacha
Brief Description: Music instrument recognition is the first step towards music understanding. In this project interested student will develop a system which can recognize music instrument in shortest possible time correctly using Fuzzy logic techniques.

Project Code: SISS01
Supervisor: Prof. Srinath Srinivasa
Brief Description: Will be available shortly.

Project Code: SIGP01
Supervisor: Prof. GNS Prasanna
Brief Description: Will be available shortly.

Project Code: SILJ01
Title: Meta-model development for SysML models.
Supervisor: Prof. L T JayPrakash
Brief Description: Understanding model description is necessary to take up model analysis. For such analysis, this project targets proposing meta-model for SysML models through use of graph theory. The meta-model should clearly indicate the mapping between model elements, and related graph elements, along with necessary semantics to preserve the related model description. Further, the project requires development of a prototype tool as a proof of concept. This requires a basic understanding of UML (Unified Modeling Language), and graphs.
