

## **Statement of Research Interests**

### **Karma Raj Chaudhary**

I am predominantly interested in Microelectronics and VLSI technology with particular emphasis on testing and verification of chip and multicore/multiprocessor systems. Microelectronics and VLSI have been playing a pivotal role in every field of modern technology. Robotics, computer, household product, defense system etc., are examples of some of the myriad types of microelectronics etched in our daily technology applications. And I am particularly fascinated by the concepts in computer architecture and multi-core processor systems interconnected for better performance, speed and synchronization. My research agenda focuses on the question of how to hold these increasing design costs and complexity to continue exponentially improving system performance.

I worked on the project 'Arduino Radar', where my roles were to design the Arduino-based working circuit, program the overall system along with the integration and testing of the whole arrangement. Additionally, I did a major project on 'Face Detection and Tracking System' using Arduino and Raspberry Pi as the main microcontrollers. The project focused on the development of Face Detection and Tracking System and it was applicable on areas such as physical surveillance, IoT and human-computer interaction. I integrated the webcam with Arduino and servo motor to make the webcam dynamic. In the firmware section I wrote a code to control the motor in Arduino IDE using C++ as well as included OpenCV, Video Processing, JAVA and Serial libraries for the face detection. This college project is also the factor that made me penchant towards microelectronics and VLSI systems. As a course requirement, I had an exposure to design and verification of Adder circuits in FPGA using Xilinx. I verified the design with directed testbench and further explored the verification. I realised that the higher levels of integration are leading to SoCs packed with increasingly more functionality over time. Software functionality and performance must also be validated, prior to tape-out. Failure to validate the software in the system context can result in costly surprises during post-silicon validation. This has propelled me to learn more about the pre-silicon and post-silicon design and verification.

In the future, with the underlying implementation technology increasingly affecting circuit design, we must adapt and reinvent current design to circumvent technology constraints and to target emerging applications. The key challenge is to build a computer system that can effectively achieve high performance, economically feasible, general purpose and easy to program. I am interested in designing and implementing both reconfigurable and hardwired solutions to address this need. The new applications will keep up the demand for even more efficient, high performance computation. So increasingly design should be in high volume coupled by economic feasibility as well. My area of research would be to find a new approach

to keep economically feasible and solution towards enduring challenges of processor architecture and circuit design.

Today's micro-architectural designs are being shaped by challenges of deep submicron silicon manufacturing, limited pins, increasing prevalence of transient faults, increased leakage and power dissipation as a first order constraint. And modern processors spend much of their execution time stalled on long latency memory access. My area of research would be on how do we overcome long server error detection and latencies and how do we overcome pre silicon verification challenges and post silicon verification challenges like logic bugs and electrical bugs.

The Microelectronics and VLSI program of IIT Kharagpur will provide me with an opportunity to research on the long term and enduring challenges in this facet. Thus such necessitates carve strong collaborative bonds and help embark on multi-disciplinary research projects. Advanced VLSI laboratory of IIT Kharagpur is a state of the art center for advanced research in VLSI Design, test and CAD where more than 100 chips have been designed, fabricated and successfully tested. IIT Kharagpur's several research groups, who have specific areas of expertise, such as Digital Design, Analog Design, RFIC, Power management, Test, Verification CAD, and MEMS will surely help me in research and it will be a great opportunity for me to join such an institution.