VLSI – where small is beautiful

IIT-Madras scouts for tie-ups to enhance reach of projects

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CHENNAI: To enhance the reach of various VLSI (Very Large Scale Integration) projects developed by its students and faculty, the IIT-Madras is in talks with many hospitals, educational institutes, research organisations and governments for tie-ups.

An interesting project in the pipeline is the ongoing research with Sankara Nethralaya. Under it, professors and students of the IIT-Madras are applying machine-learning techniques to interpret disorders including glaucoma and diabetic retinopathy. "With proper image processing techniques, we are looking at interpreting data from pictures and help in providing timely intervention through proper diagnosis," says Kamakoti Veezhinathan, professor, Department of Computer Science and Engineering, IIT-Madras.

Other interesting projects include monitoring of the structural health of bridges, intelligent sensory devices, weather forecasting and radar processing applications. Prof. Kamakoti says that since VLSI research is largely consumer-driven, there is a lot of dependence on feedback from industry. "We want to add a dimension to research by rendering solutions to real-world problems. To improvise on our design ideas, it is necessary that we don't stick to academics alone, and start giving shape to our applications."

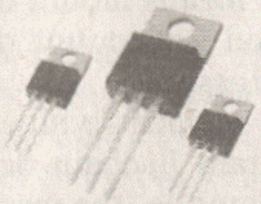
Seventy students and over 50 faculty members from different backgrounds of engineering are part of this centre of excellence at the IIT-Madras that will showcase and facilitate research on innovative projects in embedded systems and VLSI design.

Since many VLSI problems have non-deterministic solutions, it depends on heuristics for sub-optimal solutions.

A concern, says Prof. Kamakoti, is that while a lot of electronic devices are made in India, the chips are built in foreign countries, with specifications set by international foundries. "There is no guarantee that these systems perform the required functions. It is extremely important that we start looking at strengthening our indigenous manufacturing capabilities and develop our own state-of-the-art hardware designs."

VLSI FOR DUMMIES

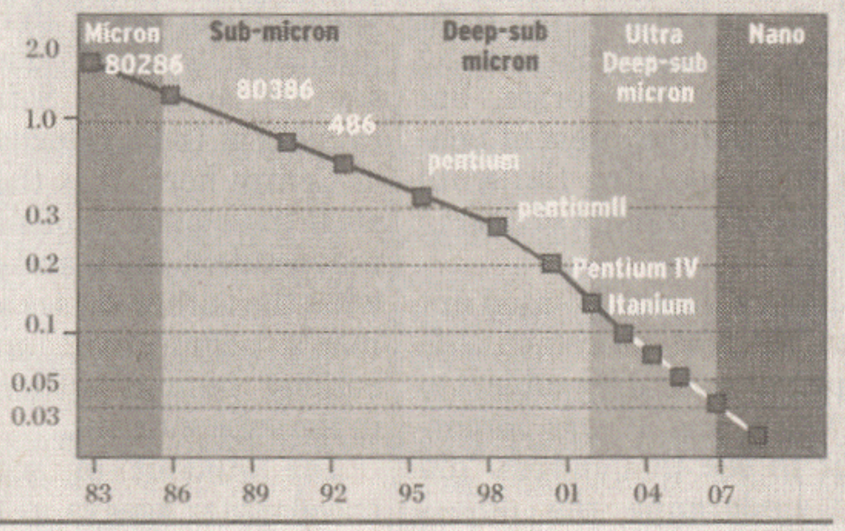
Very large scale integration (VLSI) is the process of creating integrated circuits by combining thousands of transistors into a single chip. The microprocessor is a VLSI device.



In 1946, the first computer measured several cubic ft. The chip introduced in 1997 had over a lakh transistors on it and was just 35 mm². A transistor is a semiconductor device used to amplify and switch electronic signals.

A well-maintained strand of hair is around 56 μm thick. The thickness of a transistor used in data processors now is 1/1000th of it.

The transition wherein the size of the chip reduced by half and the number of transistors on it doubled every year was fuelled by VLSI that started in the 1970s.



VLSI enables devices to perform multiple functions intelligently:

More people can do more work. Hence, more transistors impart more functionality to the device.

HOW DOES THE CHIP DESIGN OCCUR

HDL such as Verilog and Bluespec are used to describe the circuit to the computer → Language gets converted into logic gates keeping in view the specifications set by Foundries → Planning, placement and routing of the standard cells like adders, multipliers, flip flops on the chip → Lithosimulation tests the millions of masked chips. Companies aim for at least 98 per cent of the chips to work fine. ↓ Design closure. As VLSI is ridden by industry and consumer demands, companies with the shortest design closure surge ahead of others. ← In case of delays, back annotation to previous steps takes place resulting in losses in time and money.

With inputs from Prof. V. Kamakoti, IIT Madras