Big Ideas for a Micro World

BLAZING NEW TRAILS IN ELECTRONIC CHIP MODELING

ANDREW LABUN, ASSOCIATE PROFESSOR, ELECTRICAL ENGINEERING

I came to realize that the sharing of knowledge—and being able to pursue interesting research not strictly tied to a corporate mandate—was very important to me. I want to convey some of the excitement of engineering to the students.

Large semiconductor integrated circuits such as microprocessors are the most complex engineered structures known. Paradoxically, they are composed of very simple components designed according to very simple rules.

According to Andrew Labun, a prominent researcher specializing in electrical engineering, this simplicity makes it possible to use computer software to automate circuit design and to check drawings for errors and problems, long before the chips are ever made. It is technology that can save huge costs in research development.

Labun's research aims to spur development of complex structures on chips that aren't simply electronic, but might also include small machines or gas channels for all sorts of applications such as "labs-on-a-chip."

The focus of this research is on the layout—essentially the drawing—of electronic structures, which shows the shapes and placement of all the transistors, interconnecting wires, and all other aspects of the chip, as they are to be manufactured.

There's irony in the way Labun holds his thumb and forefinger slightly apart and explains, "These structures are as big as a micron across. They aren't very big at all. Line up 10,000 of them and they'd stretch out for a centimeter."

The goal of Labun's research is to develop software tools to automatically analyse the layout and perform rapid, automated analysis of various physical effects, such as diffusion of heating and gas diffusion as well as sensitivity to manufacturing variation.

Automating the analysis of non-electrical aspects of a chip layout will mean that engineers can analyse chips which combine electrical and non-electrical functions, ultimately enabling engineers to design more complex structures on chips than ever before and to check their designs to make sure they'll work without having to build them first.

Development of new products based on these complex structures will be faster, less risky, and more feasible.

The semiconductor industry Labun works in is well known for jealously guarding its secrets, particularly in research. Yet Labun's approach is different. "I came to realize that the sharing of knowledge—and being able to pursue interesting research not strictly tied to a corporate mandate—was very important to me."

Sharing knowledge is a prominent component of Labun's teaching; he is keen to engage students in research and offer them extensive and rare industrial experience in the world of microprocessor modeling.