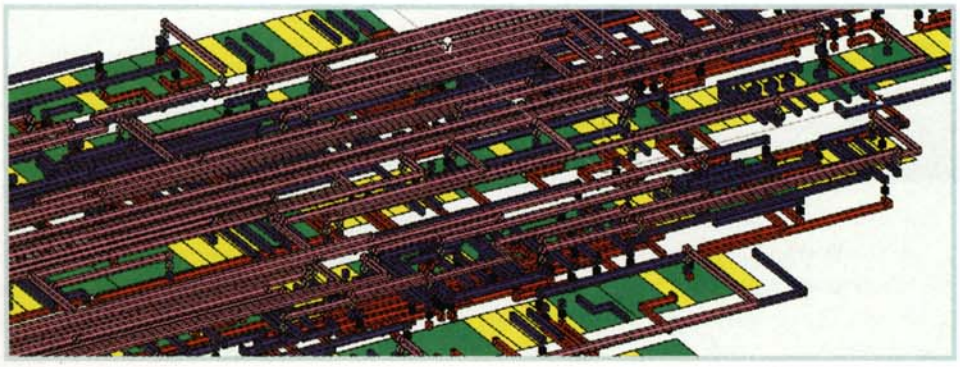
by Larry Sumney

Advancing Semiconductor Technology



In the early 1980s, the U.S. semiconductor industry had a problem—declining research in silicon integrated circuit (IC) technology. Government research programs were funding special needs such as defense, but not the broader research goals called for by the high-volume commercial markets for semiconductors. In addition, a lack of appropriately educated science and engineering graduates triggered concern among the leaders of the semiconductor industry.

In 1982, the Semiconductor Industry Association founded the Semiconductor Research Corporation (SRC) as a not-for-profit subsidiary. This corporation plans, implements, coordinates, and manages cooperation between the U.S. semiconductor industry and university research, which provides an essential foundation for the proprietary R&D activities of the individual companies. Through such joint ventures the SRC cultivates more research in silicon IC technology and helps to produce more well-educated science and engineering graduates.

The SRC started with 11 founding companies, and has grown into a consortium of more than 60 companies and government organizations—including AT&T, the National Institute of Standards and Technology, Digital Equipment Corporation, the National Science Foundation, Hewlett-Packard Company, the Office of Naval Research, and many more. As a group, the SRC plans, directs, and funds long-range semiconductor research in universities; the research projects address precompetitive topics and concepts that support industry-defined needs. Currently, it supports and directs cooperative research in more than 40 U.S. universities.

The research agenda of the SRC ranges widely, but each project promises some benefit to the corporation's primary interest—advancing silicon ICs. The corporation is organized into eight areas, paralleling the thrust areas of the National Technology Roadmap for Semiconductors: (1) design and test, (2) process integration, devices, and structures, (3) environment, safety, and health, (4) lithography, (5) interconnections, (6) materials and bulk processes, (7) assembly and packaging, and (8) factory integration. The SRC is able to maintain close ties between university research in these areas and the semiconductor industry by implementing a system of mentoring, reviewing, transferring technology, and rapidly communicating results.

Over the SRC's 13-year history, it has invested more than $300 million in research on silicon ICs. The corporation has contributed to more than 8,000 research reports and has prepared more than 1,200 graduates to become productive participants in industry.

TimberWolf's trail

Although the SRC works primarily on projects defined by the needs specified by its technology roadmap, the corporation also remains alert for new directions of research—paradigm shifts. For instance, the increased complexity of ICs—dealing with millions of transistors that are interconnected into functioning circuits—tests a designer's capabilities. One SRC-funded project eased the ever-growing design dilemmas.

In 1988, the SRC began funding a research program led by Carl Sechen, first at Yale University and now at the University of Washington. Sechen and his colleagues hoped to create a software tool that would help lay out an IC. They succeeded by producing TimberWolf, which provides automatic layout capability to optimize timing in the placement and routing of both gates and cells. In 1994, Sechen and his colleague William Swartz received the SRC Technical Excellence Award for their work in layout optimization. This software became so popular that it spawned a company called TimberWolf Systems, Inc., in Dallas, Texas, where Swartz serves as president and CEO.

Beyond TimberWolf, SRC researchers have created hundreds of other successful products, ranging from new materials and device structures to packaging innovations and software. The SRC holds periodic meetings to transfer these results to industry. In the last year alone, the SRC sponsored short courses on circuit simulators, transient enhanced diffusion, micromachined structures, short-channel IGFET models, PICES (the most widely used and best known of the two-dimensional device-modeling programs), and 10 other products that were ready for transfer to users.

Keeping current

Despite the SRC's past successes, the future may bring new concerns. The SRC hopes to meet those concerns by concentrating on its overriding goals: increased efficiency and effectiveness in responding to industry's needs. Providing the right responses depends largely on ever-improving interactions between the SRC, the semiconductor industry, and universities. The SRC expects to achieve that through several approaches, including electronic collection and dissemination of research results and helping members to improve the correlation between their specific needs and the research agenda.

All indications point to growing importance for the cooperative type of research being carried out by the SRC. To remain viable in the face of declining government support and an increasingly competitive world, other industries might also sustain their technological advances by adopting the SRC's paradigm. For more information contact the SRC (919-942-9400).