

Software design courses **BOOST** corporate operations

A series of ECE graduate-level software engineering courses has become a model for joint university/industry ongoing education. Developed four years ago by Robert Broadwater, *Object-Oriented Software Development I and 2* (ECE 5575 and ECE 5576) are taught on campus, as distance learning courses, and at Lockheed Martin's Manassas facility.

Broadwater described the courses as software design, not software development and programming. The first course employs models of classes, states, interactions, constraints, and message design, among others. The second course covers logical and physical design.

"The courses are aimed at engineers who do not have significant experience in software development," he said. "Software development projects have become so massive, so detailed, that we now need to manage it on a higher plane," he said. "Software development is moving toward abstract models."

Software design, like other engineering design, involves practices and principles, he said. "Just like in circuit design, we develop models and abstractions. We test our models against proven principles and practices, and only after we have confidence in the design do we build it," he said.

"The course is oriented toward engineers and physicists who are accustomed to thinking in terms of abstract models," Broadwater explained. "Success requires creativity, however. I can teach you the models, but not that spark of inspiration."

Working engineers who have taken the courses testify to their usefulness. Mark Rutherford, an engineer with Framatome ANP in Lynchburg, Virginia, who took the initial two courses through the distance-learning option,

found that the courses directly contributed to his team's development of a new software product for the electric industry.

"The courses provided the means to design the blueprints for software," Rutherford said. "It's much like the construction business. A contractor does not build a significant building without blueprints. Software programmers frequently ignore this critical element." Without the courses, he doubts the product would have been conceived so quickly, he added.

Lockheed Martin contracts to have the courses taught annually at its Manassas facilities, filling all available seats with its own engineers. The close university/industry partnership ensures that Lockheed engineers get the most out of the course, according to Ed Lewis, Lockheed Martin's site education manager.

"As a result of this training, Lockheed Martin Maritime Systems and Sensors Undersea Systems has been able to directly apply object-oriented thinking into our business, which we believe will allow us to provide higher productivity, longer life cycles and lower cost solutions to our customers," he said. "One of the work groups that has worked the closest with Dr. Broadwater is proposing a new approach to the systems integration business, which we believe has the potential to revolutionize the products we produce for our customer."

This past year, the firm started a course in object-oriented architecture as a follow-on to the first two courses.

"This education/business relationship is the model for how to embed training into the workplace and have the universities and businesses combine academic and real-world concepts together to bring technology to a higher level," Lewis concluded.

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- Wireless Networks and Mobile Systems
- Advanced Topics in Multiple Antenna Systems
- Spread Spectrum Communications
- Electric Power Quality for Economy
- Wide Area Monitor System Design
- Power Electronics Integration Technology
- Solid-State Matter & Devices
- Decentralized Control