Whole Building Simulations Course at the University of Hawai`i School of Architecture

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Christopher Strahle presenting his course project.

The process of designing low energy consuming buildings has entered a new realm with the emergence of high performance building modeling and simulation software tools. It has left behind the conventional computer-aided design (CAD) process, where ink and paper has been replaced by electronic "lines" for more productive drafting. The new design process incorporates three dimensional (3D) modeling where the building structure and components are defined geometrically and assigned attributes, such as material type, heat transfer properties, per unit energy consumption, or other parameters.

The performance of buildings, in terms of overall energy consumption, heat losses or gains, or air movement is an important aspect as we move toward sustainable buildings. Using whole building simulation software, the designer can now predict fairly accurately what a suitable building design is and how design alternatives compare to each other in regard to life cycle costs.

Under a job training grant from Oahu Worklinks, instructors at the School of Architecture's Environmental Research and Design Lab (ERDL) organized a course for senior students and professionals from the industry to use building simulation software for design and optimization. The 15-week course taught fundamentals of building science, which are crucial for the understanding of high performance buildings, as well as application of DesignBuilder, a simulation software. This software is a powerful integrated building, 3D-modeling and simulation tool which has several modules to simulate different aspects of building performance. This enables a fast and effective analysis of different building design variations.

The course brought together 20 students. Fifteen took the class in the regular classroom setting and five students joined online from the mainland. Students in the classroom joined those participating online to give presentations or raise questions related to class presentations. This "hybrid" virtual classroom resulted in a very successful integration of all students.

As part of the class assignments, students worked on projects which included energy simulations and optimization of buildings, assessment of energy savings through various daylighting strategies, and the assessment of wind driven ventilation in buildings, thus avoiding energy wasting fans and heating, ventilation, and air-conditioning systems. Christopher Strahle, University of Hawai'i at Mānoa (UH Mānoa) graduate, applied this technology to his doctorate of architecture dissertation project. He said, "I used what I learned in this class to finish my project and graduate on time in May."

Upon completing the course, five students were selected to work part-time at either a local architecture firm or for the UH Mānoa campus planning office and apply their simulation skills to new designs and building retrofits. This internship is intended to not only allow students the opportunity to hone their skills, but to also educate the firms on the value of this technology.

The course instructors were Manfred Zapka, an engineer and UH Mānoa adjunct professor, Kim Suman Claucherty, an engineer and architect, and George Somers Reid, a UH Mānoa teaching assistant. The strategy to train students and increase the technical capacity at the University of Hawai`i and to apply these skills to research projects as well as to projects for the UH Mānoa campus is being developed by Stephen Meder, Eileen Peppard, and colleagues at the Hawai`i Natural Energy Institute, James Maskrey and James Griffin.

Stephen Meder is the director of the UH Sea Grant Center for Smart Building and Community Design, director of the UH School of Architecture's Environmental Research and Design Lab, and interim assistant vice chancellor for physical, environmental and long range planning.

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