Project title: Automated Image Analysis of Honeycomb

Brief Description of Design Project Goals:

Overview: Honeycomb panels are widely utilized for their high strength to weight ratio, in everything from impact-safe packaging to naval, automotive, aircraft, and aerospace structures. For purposes of easy design and fabrication traditional honeycomb consist of regular hexagonal cells. These panels are often used to support non-uniform pressure profiles and are connected via heavy or intricate mechanical joints. In nature, however, honey bees intersperse hexagonal cells of different sizes to adapt to changing colony needs and practical environmental constraints in a continuous manner. The behavior of bees in these boundary regions remain largely unstudied. It seems likely that, through evolution, bees have developed near optimal design strategies to produce comb that is structurally sound, use minimum material, facilitate the needed storage capacity for food and brood, and is robust to minor variations in fabrication. In an effort to optimize the design of traditional industrial honeycomb panels, our lab is developing automated methods to study the composition of natural comb.

Specific MEng Contribution: The student will contribute by developing image processing software able to automatically detect the geometrical properties of honeycomb cells in photos. Using either Matlab or OpenCV the student will train a neural network to detect the junction between cell walls and thereby derive the cell area, wall length, and angles between walls. The accuracy of this data set will be compared against manually measured data, and the tool developed will be used to gather large amounts of statistical data of both uniform and non-uniform comb. Part of the project will be devoted to developing a good camera setup to get useful images. Team-wide weekly meetings will be held to ensure project progress. If the student has interest, this project can also involve work with actual honeybees.

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Number of MEng Students Needed: 1

Required Skills: We need a smart, motivated, and creative student, who is excited about biology, computer vision, and practical implementations. You will work as part of an overall team, but independently on your own project. The student must be familiar with programming in C/C++ or Python, and have some background with computer vision and/or OpenCV.

Estimated Project Time Frame:

2017-18 Academic Year, Two (2) Semesters