



Raja Ganesh (front) and Subramani Sockalingam won first place in the American Society for Composites inaugural Student Simulation Challenge.



TOP STORY

CCM ENGINEERING DOCTORAL STUDENTS WIN COMPOSITES SIMULATION CHALLENGE

Two University of Delaware mechanical engineering doctoral students working in the Center for Composite Materials, Subramani Sockalingam and Raja Ganesh, took first prize at the American Society for Composites (ASC) inaugural Student Simulation Challenge held Sept. 9 at Pennsylvania State University.

The goal of the 12-hour competition, held during the annual [ASC Technical Conference](#), was to see which student team could best predict the behavior of a composite laminate material that included a pattern of holes.

Composite laminates are consolidated layers of composite lamina that are valued for their strength and stiffness. The most commonly known composite laminate is carbon fiber/epoxy, which is used in the aerospace and automotive industries to reduce weight without sacrificing strength.

“In the aerospace industry, the use of composite laminates is rapidly increasing due to their high strength, low weight, and ability to be manufactured into complex geometries, among other factors,” said Sockalingam. “Of particular interest are structural components with discontinuities — holes and cutouts — which are often used to fasten structures together.”

However useful, Sockalingam continued, having a hole in a composite weakens the surrounding area and subjects the material to increased likelihood for failure under certain load conditions, important considerations in aerospace applications.

TOP STORY
Continued

“Strength and failure are important design considerations for engineers to meet safety requirements. You want to be able to predict accurately any failure because once it fails it’s no good, so researchers try to prevent the damage through testing,” explained Sockalingam.

Competing teams were given limited data about the composite’s properties and charged with calculating the maximum load the material could support. Teams had to predict additional information about the unknown composite’s properties and run computer simulations to determine the needed information.

Thinking on their feet, the UD team ran two simultaneous simulations — one broad simulation to capture major data about the material’s performance, and another more detailed simulation to validate their predictions and accurately depict the material’s load carrying capability. Their results most closely matched those of the contest organizers, earning them first place in the competition, which included a certificate and \$1,000 cash prize.

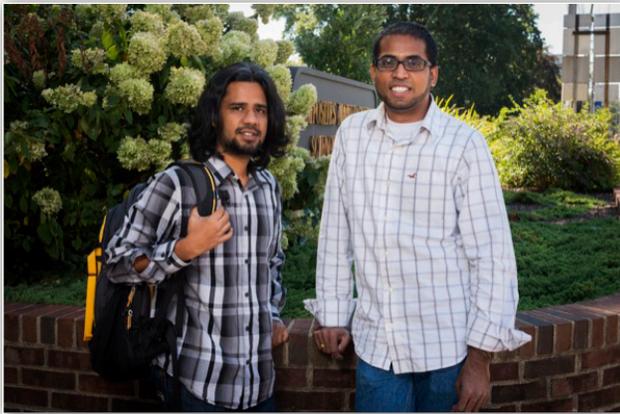
The UD team was advised by Jack Gillespie, director of the Center for Composite Materials (CCM) and Donald C. Phillips Professor of Civil and Environmental Engineering, and professor of materials science and engineering and mechanical engineering; Bazle Haque, assistant professor of mechanical engineering; and Michael Keefe, associate professor of mechanical engineering.

Sockalingam, a third-year doctoral student studying mechanical engineering, conducts research at CCM focused on modeling high performance polymer fibers and fiber-matrix

interface subjected to high velocity impact and bridging length scales from fibers to yarns. He hopes to pursue a research career in the automotive or aerospace industry, or at a national laboratory, and said the competition “helped us understand the kind of simulations one would conduct in the industry as part of the product development process”.

Ganesh, a first year doctoral student also studying mechanical engineering and conducting research at CCM, said he hopes to become a professor.

Article by Kevin Cella



NEWS

Cosmic Composites

The University of Delaware Center for Composite Materials is part of a team led by ILC Dover that has received a \$4.4 million contract from NASA to design, manufacture, and test a next-generation spacesuit.

According to Steve Scarborough, R&D Engineering Manager at ILC Dover, the so-called Z-2 will be the next advancement in space suits, designed to be used in the future manned exploration of the moon or Mars.

Scarborough explains that the Z-2 space suit has a number of rigid composite components.

“Composite materials have been selected for these components because of their significant mass savings over metals,” he says. “We added CCM to the team for their composite structural analysis and composite impact analysis and test capabilities, including nondestructive testing and evaluation capabilities. ILC has manufactured rigid composite structures for decades, but we thought CCM could assist us in the composite material and processing development using the latest process modeling techniques to minimize production start-up costs.”

The new suits, which will operate at higher levels of pressure than earlier models, will be designed for use with NASA’s portable life support system, currently under development at the Johnson Space Center in Texas.

CCM Scientist Bazle Haque says the challenge in the space suit project is to design a material that can meet all of the requirements of the application, including inflation pressure and temperature.

The team will be operating under a tight time schedule, with just six months to develop a design and conduct limited testing followed by nine to ten months for manufacture and delivery of the final product.

The Z-2 is the second in a series of three prototypes that could be worn by NASA astronauts stepping onto the surface of Mars within the next 25 years. The Z-2 will offer greater range of mobility over the Z-1 as well as improved ease of motion. The agency plans to have the Z-3 model ready for testing in 2016.



Z-1 Spacesuit (above) will be replaced with the Z-2 space suit, which has a number of rigid composite components.

Scarborough says his company selected CCM because they recognized the many ways that the center would strengthen ILC's space suit development team.

"We knew many of the personnel at CCM and their expertise with composites through ILC's participation in SAMPE," he says. "We look forward to transitioning the composite component production to ILC from CCM's Application & Technology Transfer Lab. We are excited to be working with UD CCM on this project and hope to work on additional projects in the future."

Other partners on the contract include Air-Lock Inc., Analytical Mechanical Associates, World Wide, Devilsfork Consulting, and the Philadelphia University.

Source: "Updating a cosmic wardrobe", Fishman, Margie; *The News Journal*; (Jul 4, 2013)

CCM participates at Second Annual National Manufacturing Day

On October 4, CCM participated in the second annual National Manufacturing Day celebration - an event designed to showcase the importance of manufacturing to the nation's economy and to draw attention to the many rewarding high-skill jobs in manufacturing fields. In its first year, more than 240 events were held in manufacturing facilities in 37 states and more than 7,000 people participated. This year's celebration featured open houses, public tours, career workshops and other activities to increase public awareness of modern manufacturing. These events also introduced manufacturers to business improvement resources and services delivered through the MEP's network of hundreds of affiliated centers across the country.

Dr. Dirk Heider, Assistant Director of Technology at CCM says "CCM participates in the Delaware Valley Industrial Resource Center (DVIRC) led Advanced Manufacturing Accelerator Challenge, a national competition sponsored by the Obama Administration to support manufacturing activities. The Accelerator helps to enhance a region's capacity to create high-quality sustainable jobs in manufacturing and accelerate technological innovation. CCM is actively seeking out opportunities to collaborate with regional companies to develop innovative composite solutions and to grow opportunities for our students to transition into local jobs."



UDaily

Multifunctional Nanocomposites

Funding from Korean agency supports research in nanocomposites

9:43 a.m., Oct. 7, 2013--Tsu-Wei Chou, Pierre S. du Pont Chair of Engineering at the University of Delaware, has received funding from the National Research Foundation of Korea to support research in advanced hybrid nano- and micro-composites for structural and multifunctional applications.

Chou is collaborating with Byung-Sun Kim and Joon-Hyung Byun of the Korea Institute of Materials Science on the nine-year project, which is now in its third phase.

The Phase III research goal is to conduct fundamental studies of nano-carbon-based multiscale hybrids for multifunctional composites and energy storage devices.

The Phase I research focused on the use of dispersed carbon nanotubes (CNTs) in a matrix material for reinforcement and damage sensing of composites. In Phase II, the researchers turned their attention to carbon nanotube-based continuous fibers.

[Click HERE to read the entire story in UDaily.](#)



*Tsu-Wei Chou,
Pierre S. du Pont Chair
of Engineering*



*Qi An, a Ph.D. student
in Materials Science &
Engineering*

CCM Doctoral Student Receives TRFA Award

Qi An, a Ph.D. student in Materials Science & Engineering, is the first place winner of the 2013 Thermoset Resin Formulators Association (TRFA) Excellence in Thermoset Polymer Research Award competition for her paper "Epoxy-Based Carbon Nanotube/Fiber Hybrid Composites: Nanoscale Hybridization via Electrophoresis." Her advisor is Professor Erik T. Thostenson, Assistant Professor of Mechanical Engineering and Affiliated Faculty in Materials Science & Engineering.

In addition to receiving a cash award and plaque, An will present her technical paper at the TRFA 2013 Annual Meeting. Her paper is posted on the TRFA website and included in the conference proceedings that will be presented to all meeting attendees.

OTHER NEWS

(Continued)

UD-CCM Alumnus Works with Boeing on VTOL Project

UD-CCM alumnus Michael Mikuszewski is part of a team of Boeing researchers creating rapid prototypes of vertical takeoff and landing (VTOL) aircrafts.

The research is part of the Defense Advanced Research Projects Agency's (DARPA) X-plane competition which aims to create VTOL aircraft capable of flying with increased speed, hovering efficiency and cargo holding capabilities.

"This is what we graduate college hoping to do. Having this experience and opportunity to do it is fantastic," said Mikuszewski, who helped design and create some of the prototype parts.

Mikuszewski earned his bachelor's degree in engineering technology in 2009. During his time at UD, he conducted research at the Center for Composite Materials with associate scientist Nicholas Shevchenko.

DARPA will fund one team to create and test their design and hopes to have the aircraft fully operational by Oct. 2018.



UD-CCM alumnus Michael Mikuszewski

NEW PUBLICATIONS

Journals

Bhargava, S., R. D. Lewis, M. Kubota, X. Li, S. G. Advani, J. M. Deitzel, and A. K. Prasad, "[Adhesion Study of High Reflectivity of Water-based Coatings](#)," International Journal of Adhesion & Adhesives, 40, pp. 120-128, January 2013.

Hinton, M. J., A. S. Kaddour, S. T. Pinho, G. M. Vyas, P. Robinson, Z. M. Huang, Y. X. Zhou, A. Rotem, N. Carrere, F. Laurin, J. F. Maire, D. Zhang, L. Xu, J. Ye, Y. Huang, C. Jin, S. K. Ha, T. A. Bogetti, J. Staniszewski, B. P. Burns, C. P. R. Hoppel, J. W. Gillespie, Jr., J. Tierney, A. C. Hansen, E. E. Nelson, and D. J. Kenik, "[The Second World-Wide Failure Exercise \(WWFE-II\): Part B: Evaluation of Theories for Predicting Failure in Polymer Composite Laminates Under 3-D States of Stress: Comparison with Experiments Preface](#)", Journal of Composite Materials, (Special Issue) 47 (6-7), pp. 643-652, March 2013.

NEW PUBLICATIONS
(Continued)*Journals (Continued)*

Kelly, G. S., S. G. Advani, J. W. Gillespie, Jr., and T. A., Bogetti, "[A Model to Characterize Acoustic Softening during Ultrasonic Consolidation](#)," Journal of Materials Processing Technology, 213, pp. 1835-1845, 2013.

Conferences

Chowdhury, S. C., B. Z. (Gama) Haque, and J. W. Gillespie Jr., "Molecular Simulations of the Dynamic Impact of Graphite," Proceedings of the American Society for Composites 28th Technical Conference, State College, Pennsylvania, September 9-11, 2013.

Chowdhury, S. C., B. Z. (Gama) Haque, J. W. Gillespie Jr., T. L. Chantawansri, T. Rosch, and R. L. Karkkainen, "Molecular Simulations of Silica Surface in Presence of Water," Proceedings of the American Society for Composites 28th Technical Conference, State College, Pennsylvania, September 9-11, 2013.

Sietins, J. M., J. W. Gillespie, Jr., and S. G. Advani, "Bonding Mechanisms during Ultrasonic Consolidation: New Insight Utilizing FIB Milling and TEM," 13th Japan International SAMPE Symposium and Exhibition, Nagoya, Japan, November 11-13, 2013.

Sockalingam, S., J. W. Gillespie, Jr., and M. Keefe, "Modeling the Transverse Compression Response of Kevlar KM2," Proceedings of the American Society for Composites: Twenty-Eighth Technical Conference, State College, Pennsylvania, September 9-11, 2013.

Yu, H., A. Nonn, D. Heider, S. G. Advani, "Modeling and Characterization of the Through-thickness Thermal Conductivity of Polymer Composites using Infrared Camera," Proceedings of the American Society for Composites: Twenty-Eighth Technical Conference, State College, Pennsylvania, September 9-11, 2013.

MEMBER NEWS

We would like to thank [Toray Industries, Inc.](#), Ehime, Japan, for becoming our newest consortium member. In addition, we thank [Arkema, Inc.](#), King of Prussia, PA, [Composite Sourcing Solutions](#), Yardley, PA, [Owens Corning Science & Technology](#), Novi, MI, and [Warrior Sports, Inc.](#), Warren, MI, for renewing their memberships and continuing to participate in CCM's research and development activities.

To learn more about the benefits of becoming a member, please visit us on the web at www.ccm.udel.edu/Consortium/benefits.html



Celebrating 40 years of significant contributions to composites science and technology, the education of students, and the creation and transfer of technology to industry.

Please visit us on the web at <http://www.ccm.udel.edu>

201 Composites Manufacturing Science Laboratory ♦ phone 302.831.8149
University of Delaware, Newark, Delaware 19716-3144 ♦ fax 302.831.8525

