

Virginia Tech engineering professor honored for contributions to nonlinear dynamics

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Ali Nayfeh of Blacksburg, University Distinguished Professor in the Department of Engineering Science and Mechanics in the College of Engineering at Virginia Tech, recently achieved two prestigious professional milestones.

Nayfeh has been honored by the American Society of Mechanical Engineers (ASME) for his lifelong contributions to the field of nonlinear dynamics. Nayfeh, who has directed more than \$25 million in engineering research, will receive the newly established Lyapunov Award by the ASME Technical Committee on Multibody Systems and Nonlinear Dynamics of the Design Engineering Division at the ASME International Design Engineering Technical Conference in Long Beach, Calif., in September.

In addition, Nayfeh has been invited by the Office of Naval Research (ONR) to join its High Capacity Alongside Sea Base Sustainment (HiCASS) team led by Lockheed Martin. This team will design ship-to-ship transfer in high seas. Such transfers allow ships to refuel and restock at sea instead of becoming a possible target at a naval base and remove the need for long distance travel back to a base.

Nayfeh's research experience compliments the Navy's goal of utilizing transformational sea basing which requires the development of a high capacity, high reliability at-sea transfer capability. The HiCASS team led by Lockheed Martin is one of only three teams selected after the first round of research conducted this summer for the Expeditionary

Logistics on Future Naval Capabilities group. Virginia Tech's share of this \$1 million contract was \$525,000. The Business Technology Center at Virginia Tech played an integral role in securing this research contract.

The team combines resources from industry, academia and government laboratories to maximize available resources for problem solving, including two crane manufacturers, a mooring line designer, a fender manufacturer, and a technology gathering company. Research Associate Eihab Abdel-Rahman and Assistant Professor Ziyad Masoud, both from the Department of Engineering Science and Mechanics, are members of the HiCASS team charged with designing systems to transfer fuel, cargo, vehicles and personnel in a seaway even in challenging weather and sea conditions.

The second phase awards cap a year of effort by the Office of Naval Research to define the problems involved with ship-to-ship transfer so that specific contractor efforts could begin. Each of the three teams will assess technologies which can be used to sense, measure and predict the ocean surface and wave effects on the vessels that are transferring cargo. The teams differ by the cargo transfer technology they will use and their approach to demonstrating its effectiveness.

The Lockheed Martin team effort will build on a Super-Smart Crane Controller that Nayfeh developed with prior ONR funding. The team plans to demonstrate its system with a crane-ship simulation test bed and in a three-dimensional and one-dimensional Computer Aided Environment (Cave) at Virginia Tech.

Among his contributing research achievements, Nayfeh has developed: a novel wave envelope method to analyze acoustic waves in aircraft engine-duct systems; a new methodology for controlling ship motions which is being used in the industrial design and evaluation of ships; and

developed a system for controlling the pendulation of military and commercial cranes which is being implemented on container cranes and ship-mounted cranes for naval and commercial applications. His method of multiple scales is the method of choice for treating nonlinear vibration problems.

Nayfeh's research and teaching career at Virginia Tech has spanned 34 years. "As an accomplished researcher and professor, Nayfeh has produced a significant legacy by having graduated 75 doctoral and postdoctoral students who have also made important contributions to research and teaching. More than half of the alumni from his research group hold faculty positions. The others are making equally important contributions to industry," said Ishwar Puri, professor and head of the Department of Engineering Science and Mechanics.

Nayfeh has previous industrial experience with Heliodyne Corporation and Aerotherm Corporation. He is a Fellow of the American Physical Society, the American Institute of Aeronautics and Astronautics, the American Academy of Mechanics, and the ASME. Nayfeh serves as editor-in-chief of the leading international journals that address the state of the art in their fields: Nonlinear Dynamics and Vibration and Control. He received his bachelor's degree, master's degree and Ph.D. from Stanford University.

Source: Virginia Tech

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