RAJAICCM18PLENARY

ICCM-18 PLENARY PRESENTATION- ABSTRACT DR. YAPA D. S. RAJAPAKSE

“Challenges in Composites Research: ONR Perspectives”

Dr. Yapa D. S. Rajapakse
Program Manager, Solid Mechanics
Office of Naval Research

Arlington, VA 22203-1995, U.S.A.

ABSTRACT

The current emphasis on energy efficient, reliable, Naval structures with enhanced capabilities and reduced life cycle costs, has led to increased use of composite materials in ship structures. The marine environment is hostile, with the presence of high humidity, sea water, wave loading, hydrostatic pressure, and temperature extremes. The performance of composite marine structures in this environment, and the challenges encountered, are the central themes addressed by the Solid Mechanics Program of the Office of Naval Research (ONR).

At the present time, the research focus is on mechanics of marine composite materials and composite sandwich structures. The program deals with understanding of, and establishing physically based models for, the physical processes involved in the thermo-mechanical response of glass-fiber and carbon-fiber reinforced marine composite materials and composite sandwich structures, subjected to static, cyclic, and dynamic, multi-axial loading conditions in severe environments. The establishment of these models, with predictive capabilities, requires multi-scale, multi-physics analysis. Avenues for enhancing the performance of marine composite structures through the introduction of nanoparticles (and nanotubes), and through the incorporation of novel design concepts, are also being explored in this program. Research on multifunctional composites seeks to enhance performance through the incorporation of additional beneficial attributes, without compromising on the mechanical properties.

Some recent research accomplishments will be summarized. Examples include: damage sensing utilizing carbon nanotubes; dynamic failure under fluid-structure interaction; accelerated testing methods for life prediction; characterization and modeling of hierarchically structured composites; mixed mode fracture of foam core; dynamic fracture of foam core materials; higher order sandwich panel theory; nonlinear thermo-mechanical response

of sandwich plates; fatigue of sandwich beams; blast response of composites and sandwich plates; progressive damage and failure of curved sandwich structures; and response of sandwich panels during hull slamming.

The presentation will include a discussion of future directions of research in mechanics of marine composites and sandwich structures for affordable naval structures, with enhanced performance and reduced life-cycle costs. Areas of increased emphasis include: structure/fluid interactions; shock, blast, and implosion effects; and coupled effects of sea water, temperature extremes, and highly dynamic loading.