

# The 2013 DCAMMM Annual Seminar Speaker

## Gaëtan Kerschen

Professor of Aerospace Engineering  
Space Structures and Systems Laboratory  
Department of Aerospace and Mechanical Engineering  
University of Liège, Belgium

gives the following lecture at the

### Technical University of Denmark

Auditorium 72, Building 421  
Produktionstorvet, 2800 Kongens Lyngby

## Natural Frequencies and Normal Modes of Nonlinear Aerospace Structures

**Wednesday, November 27, at 14:00**

There will be an open discussion after the lecture

**at 15:00**

(Refreshments are served)

This lecture aims at popularizing mechanical science to a broad audience of interested students and staff as well as engineers working in industry.

The Danish Centre for Applied Mathematics and Mechanics, DCAMMM, is a framework for internationally oriented scientific collaboration between staff members at a number of departments at the Technical University of Denmark, Aalborg University and Aarhus University. The "DCAMMM Annual Seminar Speaker" is an initiative created to disseminate mechanics to a broader audience.  
*For further information on DCAMMM, see [www.dcammm.dk](http://www.dcammm.dk).*

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### Natural Frequencies and Normal Modes of Nonlinear Aerospace Structures

**Abstract:**

The concept of natural frequency and normal mode is central in the theory of vibratory systems. Besides their obvious physical interpretation, the normal modes have interesting mathematical properties such as orthogonality and superposition. They are therefore used in structural dynamics for various purposes including model reduction, model validation and structural health monitoring. One important assumption underlying classical modal analysis is that the considered structure behaves linearly in the regimes of motion of interest.

Because nonlinearity is pervasive in engineering structures (e.g., gaps and friction), a rigorous, yet practical, framework for modal analysis of nonlinear systems will be presented in this talk. This framework will be used to explain nonlinear dynamical phenomena with no linear counterparts, including interactions between widely-spaced modes and mode bifurcations. It will then be applied to real-life aircraft and spacecraft for getting a profound understanding of their nonlinear dynamics. Finally, the talk will discuss how nonlinearity can be exploited for enhancing the performance of engineering structures.

