

STRUCTURAL DYNAMICS: THEORY AND PRACTICE IN THE SPACE INDUSTRY

The aim of the webinar is to provide a synthesis and an overview of the status of the art in some areas of structural dynamics as applied in the Space Industry. The webinar is proposed by a small group of internationally recognized experts from Academia and Industry.

Learning objectives:

- Overview of structural dynamics as applied in space projects

Target audience: doctoral students, non-academic professionals, and undergraduate students

Dates and time: 29 June 2021, 8:50-13:00 CEST; 30 June 2021, 8:50-12:10 CEST

Agenda and Topics

29 June 2021

- 8.50 **Welcome**
- 9.00 [Gaetan Kerschen](#)

Impact of nonlinearities on engineering structures: a spacecraft example

In this lecture, I will give an overview of the fundamental differences between the dynamics of linear and nonlinear systems. I will discuss the principle of superposition, the frequency-amplitude dependence of nonlinear oscillations, the concepts of harmonics and bifurcations. An Airbus satellite, the SmallSat spacecraft, will be taken as a real-life example to illustrate the peculiar dynamical features of nonlinear systems.

- 10.00 [Etienne Cavro](#)

Shock synthesis: an overview of methods, limitations, and experimental practices

The lecture will present the shock synthesis including methods (the “famous” Fast Sine Sweep”, wavelets, ...), experimental aspects (shocks on shaker, metal / metal impact shock, nailgun, non-linearities with respect to level on shaker, SRS limiting shocks ...) and concrete applications both academic and industrial.

- 11.00 **Coffee Break**
- 11.10 [Nicolas Roy](#)

Modal identification: state of the art in industry – PART 1

The lecture will cover the following concepts: overview of mode superposition including FRF and modal effective parameters; phase resonance vs phase separation testing; classical time domain and frequency domain methods (circle fit, CE, RFP); the RTMVI method; industrial applications; software demo with Primodal.

- 12.00 [Adriano Calvi](#)

Finite element model updating and validation for space hardware: a historical (and philosophical) overview

The lecture presents a short overview of the past effort for the development of methods and procedures for finite element model updating and validation of dynamically loaded structures.

The present status in terms of requirements and guidelines as reported in the ECSS (European Cooperation for Space Standardization) documentation is shortly reported. The present challenges on the subject are also addressed.

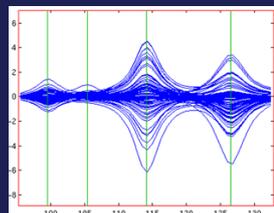
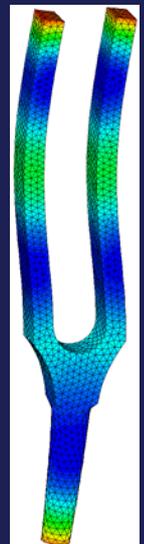
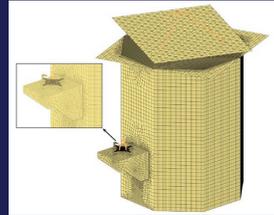
- 13.00 **End**

30 June 2021

- 8.50 **Welcome**
- 9.00 [Guglielmo Aglietti](#)

Trend and research on virtual shaker testing: methodologies and implications

The so called “Virtual Shaker Testing” (VST) is becoming more and more a common topic in the world of aerospace environmental testing. The lecture will provide a short insight into typical issues when testing large spacecraft and elaborate on how VST can help mitigating risks and optimizing costs and planning.



- 10.00 [Nicolas Roy](#)

Modal Identification: state of the art in industry – PART 2

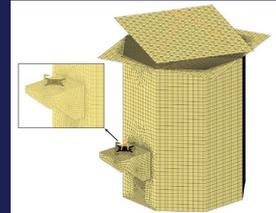
The lecture will cover the following concepts: overview of mode superposition including FRF and modal effective parameters; phase resonance vs phase separation testing; classical time domain and frequency domain methods (circle fit, CE, RFP); the RTMVI method; industrial applications; software demo with Primodal.

- 11.00 **Coffee break**
- 11.10 [Sebastiaan Fransen](#)

Spacecraft/Launcher coupled loads analysis - An overview

In this presentation I will give an overview of the theoretical methods used in spacecraft/launcher coupled loads analysis (CLA), as well as some practical example cases. Topics that will be discussed are the objectives of coupled loads analysis, the VEGA CLA Tool developed in ESA, FEM condensation and data recovery, interface forces and COG accelerations, modelling of launcher flight events and forcing functions and a CLA example case.

12.10 End



Speakers

Guglielmo Aglietti, Professor, University of Auckland.

My technical background is in aerospace structures and mechanisms, and my activities span from academic research & teaching to consultancy for industry, covering both theoretical work and experimental activity. I graduated with in Aerospace Engineering and my career started as a stress analyst at Alenia Spazio (Turin I). I then worked at ESA-ESTEC (Noodwijk NL) on various payloads for the Space Shuttle programme, and in 1995 moved to the University of Southampton where I obtained a PhD and later a Lectureship in Aerospace Structural Dynamics.

In 2013 I moved to the Surrey Space Centre, to take up the Royal Academy of Engineering Research Chair in Space Engineering co-sponsored by Surrey Satellite Technology, and later became director of the Centre. In parallel with my academic work, I have carried out consultancy work on various aspects of spacecraft structures for most of the key players in the UK space industry, SSTL, Astrium (now Airbus defence and Space), MSSL, SSBV, SULA Systems, Lockheed Martin, etc. In 2019, I moved to NZ to lead the Space Institute at the University of Auckland, with the mandate to establish research and educational activities to support the development of the local space sector.

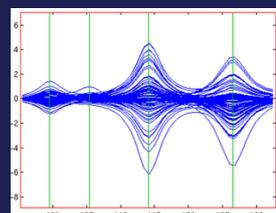


Adriano Calvi, Mechanical, Thermal and Propulsion Systems Engineer of the Euclid Project, ESA.

With over 30 years of experience in spacecraft structures and mechanical systems, he has contributed to several projects, such as Spacehab, MPLM, Columbus and GOCE. He has worked at Alenia Space, Turin, Italy, for about 10 years as structural engineer and since 1997 has moved to ESA/ESTEC, the European Space Research and Technology Centre in Noordwijk, NL.

Adriano is author over 60 publications and has contributed to several ECSS (European Cooperation for Space Standardization) documents, in particular he was chairman, technical manager and co-author of the "Spacecraft Mechanical Loads Analysis Handbook". He is lecturer in Spacecraft Mechanical Loads Analysis at the ESTEC Training Centre.

Adriano received two master degrees in mechanical and aeronautical engineering, both from the Technical University of Turin, Italy, and his PhD in space engineering from Cranfield University, UK. In 2020 Adriano obtained the qualification as Associate Professor in Aerospace Engineering in the Italian University system.



Etienne Cavro, Specialist in Structural Dynamics, Airbus Defence & Space.

He was graduated from the French Aeronautics and Space School of Engineering (Grand Ecole "Supaero") in 2001. After a few years dedicated to software applications for dynamic analysis and predictions, he became a specialist in structural dynamics at Intespace which is now the Airbus Defence & Space environmental test centre in Toulouse. His main fields of expertise are dynamic tests analysis and methods. He was involved in various R&D studies for ESA and CNES and satellite test campaigns (Biomass, Euclid, MetOp-SG instruments ...).



Educational Series & Academy

He is also a lecturer at ISAE-Supaero for structural dynamics and is involved in training sessions related to structural dynamics. He is also part of the French expert group dedicated to the elaboration of the French military standard for the consideration of the mechanical environment to derive test specifications.

Sebastiaan Fransen, Mechanical System Engineer of the ATHENA X-Ray Space Telescope, ESA. He received his master's degree from the Delft University of Technology in the Netherlands in 1992, and his Ph.D. degree from the same university in 2005. From 1992 until 1999 he worked predominantly as a research engineer at the Faculty of Aerospace Engineering of the Delft University of Technology. In 1999 he joined ESA/ESTEC, first as a consultant and since 2009 as a staff member of the Structures Section TEC-MSS. Since 1999 he has been working on the development of condensation methods, coupled loads analysis methods, damping methods and associated software tools in both Nastran and Matlab. As a structural dynamics engineer he contributed to various launcher and satellite programmes such as the ISS payloads, Ariane-5, VEGA, Herschel, SPICA, ATV, LPF and Galileo. Since 2014 he is working as a mechanical system engineer on the development of the ATHENA X-ray space telescope which is currently in Phase B1.

Gaëtan Kerschen, Professor, University of Liège.

He completed his Ph.D. degree in Aerospace Engineering from the University of Liège in Belgium in 2003. In 2003 and 2004, he was a visiting postdoctoral fellow at National Technical University of Athens and at the University of Illinois at Urbana-Champaign. Since 2007, he has been a faculty member at the University of Liège, where he is a professor in the Department of Aerospace and Mechanical Engineering. His expertise is primarily in the area of structural dynamics and orbital mechanics. He is the recipient of several international awards including two European Research Council (ERC) grants, the Doak Award from the Journal of Sound and Vibration and the SAGE Publishing Young Engineer Award. He was one of the principal investigators of the OUFIT-1 nanosatellite launched by the Soyuz rocket in 2016. He is the co-founder of NOLISYS, a startup company which provides solutions and software for nonlinear vibrating systems.

Nicolas Roy, Expert in Structural Dynamics, Optimization and Robust Design, Top Modal.

He is an expert in structural dynamics, optimization and robust design with over 30 years of industrial experience. With a M.S. from Caltech and Ph.D. from Penn State University, Dr. Roy worked at Lockheed Martin (Sunnyvale, CA), ONERA (Toulouse) and Intespace (Toulouse) before founding Top Modal in 2003. Dr. Roy is also an instructor and lecturer at several universities and training centers in Europe and Asia, as well as co-author of the book Structural Dynamics in Industry available in English and French.

Registration and Webinar Platform

The registration is mandatory via the online form at the web link.

Deadline: 22 June 2021

Fees: there are no registration fees for AIDAA members. Instructions to become a member can be found here: <https://www.aidaa.it/become-a-member/>

Webinar platform: Webex, a link will be sent via email a few days before the event.

