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Automatic  
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The Department of Automatic Control & Systems Engineering  
is pleased to announce the following seminar:

## **Evidence-Based Robust Optimisation Applied to Space Systems Engineering**

**Professor Massimiliano Vasile**

*Department of Mechanical & Aerospace Engineering  
University of Strathclyde*

**Wednesday, 19<sup>th</sup> November 2014 at 14:00**

LT02, Sir Henry Stephenson Building

### **Abstract**

In an expanding world with limited resources and increasing uncertainty, optimisation and uncertainty quantification become a necessity. We abandon the idea to fully predict everything within a model of reality and we embrace the stochasticity inherent in all decision making processes and in the intimate nature of things. When a computer model is used to predict the performance of a system or process additional uncertainty needs to be considered. This uncertainty depends on our current knowledge of the system or process and is therefore epistemic in nature. Nowadays, the use of computer models has become an essential part of any decision process and design methodology. It forms the backbone of Model-Based System Engineering and of the concept of Virtual Prototyping (VP). A common approach to account for uncertainties in system design is to add safety margins. These margins are generally defined through experience and historical data rather than through a propagation of uncertainty through a system model. However, it can be shown that the use of predefined design margins can lead to an overestimation of the system budgets or of its reliability.

This talk will introduce the concept of Evidence-Based Robust Optimisation for the treatment of epistemic uncertainty in space systems engineering and some recent results on the solution of single and multi-objective robust problems under epistemic uncertainty.

### **Biography**

Massimiliano Vasile is currently Professor Space Systems Engineering in the Department of Mechanical & Aerospace Engineering at the University of Strathclyde. Previous to this, he was a Senior Lecturer in the Department of Aerospace Engineering and Head of Research for the Space Advanced Research Team at the University of Glasgow. Before starting his academic career in 2004, he was the first member of the ESA Advanced Concepts Team and initiator of the ACT research stream on global trajectory optimisation, mission analysis and biomimicry. His research interests include Computational Optimisation, Robust Design and Optimization Under Uncertainty exploring the limits of computer science at solving highly complex problems in science and engineering.

He developed Direct Transcription by Finite Elements on Spectral Basis for optimal control, implemented in the ESA software DITAN for low-thrust trajectory design. He has worked on the global optimisation of space trajectories developing innovative single and multi-objective optimisation algorithms, and on the combination of optimisation and imprecise probabilities to mitigate the effect of uncertainty in decision making and autonomous planning. More recently he has undertaken extensive research on the development of effective techniques for asteroid deflection and manipulation. His research has been funded by the European Space Agency, the EPSRC, the Planetary Society and the European Commission. Professor Vasile is currently leading Stardust, an EU-funded international research and training network on active debris removal and asteroid manipulation.