



# Centre for Process Systems Engineering

## CPSE Webinar Series - 2017

*The Centre of Process Systems Engineering (CPSE), from Imperial College London and University College London are delighted to be hosting the first Webinar*

### Stochastic multi-objective methods for dynamic optimisation problems

**Professor Eric S Fraga**  
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Professor Eric Fraga is Professor of Process Systems Engineering in the Department of Chemical Engineering at University College London (UCL) and a member of the Centre for Process Systems Engineering (CPSE). He joined UCL in 1996. Prior to this, he was a senior research fellow in the Departments of Chemical Engineering and Mathematics & Statistics at the University of Edinburgh from 1989 to 1996. He was awarded his PhD in Computer Science from the University of Waterloo (Canada) in 1988. In 2012-2013, he held the Santos Chair of Energy & Resources at UCL Australia where he was also the Academic Director. Professor Fraga's research lies at the interfaces between industrial engineering, mathematics and computer science. His research broadly falls into two categories: the development of new computational methodologies for computational systems engineering and the design and implementation of computer interfaces for aiding engineers in the use of advanced computational tools in design. In the course of his research, Professor Fraga has developed the Jacaranda system for automated design and process optimisation and

the Strawberry and Fresa nature-inspired evolutionary optimisation methods. Professor Fraga has on-going collaborations with partners across the world. These collaborations include the design of fundamental optimisation algorithms for complex problems that arise in industrial and chemical engineering, integrated energy systems, water processing for shale gas extraction, the design and optimisation of bio-fuel production processes (primarily for ethanol production) and waste processing in biofuel production. Professor Fraga has published over 140 articles in international peer-reviewed journals and conference proceedings and has obtained funding for his research from the UK's Engineering and Physical Sciences Research Council (EPSRC), the European Commission, NATO and the British Council as well as from industry.

**Abstract:** Dynamic models appear in a variety of design and simulation problems. Dynamic models consist of both differential and algebraic equations with a combination of initial and boundary values along with, in some cases, path constraints. Traditional, mathematical programming, optimisation tools for solving these problems may not be effective. It may be necessary to use less efficient numerical discretisations, the methods may not scale, and the problems may exhibit artificial multi-modal behaviour introduced by the numerical integration of differential equations. We present a number of case studies, from parameter estimation for modelling the dynamic behaviour of a system through to optimal control problems in operations. Stochastic evolutionary optimisation methods are used for these problems, some of which have multiple objectives. The stochastic methods include NSGA-II, a popular implementation of a genetic algorithm suitable for multi-objective optimisation problems, and Strawberry, our own multi-objective method shown to be better performing for a wide range of problems.

**Monday 5th June 2017 at 15:00 BST**

The talk is for one-hour online session: 40 minutes' presentation + 20 minutes' Q&A.

For information on how you can watch the webinar, please visit the CPSE Website:

<http://www.imperial.ac.uk/process-systems-engineering/courses-and-seminars/webinar-series/>