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## **John Anthony Rossiter**

In this issue of CSM, we speak with Anthony Rossiter from the University of Sheffield (UK). He received his MA and DPhil degrees from Oxford University in 1987 and 1990 respectively and following a brief post-doctoral position took up his first academic post at Loughborough University in 1992. He subsequently moved to the University of Sheffield in 2001 as a Reader.

He is most well known in the research community for his contributions to predictive control and notably the early work on proposing and understanding dual-mode approaches alongside the foundational ideas and publications behind tube MPC. Also the author of popular text books and online resources on predictive control as well as around 300 journal/conference and other publications. In parallel, he has played a leadership role in the international control community in promoting the importance of both effective pedagogy and the potential for modern technology to enhance the student learning experience. His open-access teaching resources on the web are widely used.

His current research interests are focused in areas of simplicity: how do we design a control approach which has numerous useful attributes but with minimal coding complexity and easy to understand? Current projects are looking at this in the context of human-robot interaction, UAVs and energy capture from waves. In a similar vein, his pedagogical work is based on a philosophy of ‘what works and can also be implemented simply/cheaply for both staff and student?’

**CSM:** How did your education and early career lead to your initial and continuing interest in the control field?

**Anthony:** I would probably argue this is simply serendipity (some might argue misfortune!). Having gained myself a good graduate job for the Autumn, I was persuaded by Basil to forgo this do a doctorate instead and have never managed to leave academia again apart from a 4 month placement with PowerGen in 2000! The most exciting time is being able to think conceptually about different approaches and recognising when a simple change can give significant benefits or insights. This applies to both technical research and to teaching.

**CSM:** How would you describe your teaching style?

**Anthony:** Over the past 25 years I have taught an enormous variety of courses and to engineers of every discipline. My belief is that we should expect students to be professional in their approach to their studies and in turn, provide high quality resources and a learning framework that supports conscientious students. Thus, in terms of my institution I have taken a leading role in utilising online quizzes for formative and summative assessment, examinations within a computer room to exploit software and thus ask more interesting questions, providing videos of core topics students can use for independent learning, promoting the development of take home laboratories, providing virtual laboratories students can access anytime, using student response technology in lectures, lecture recording and so on. My basic style would probably be described as demanding; I am explicit with students about my expectations of them: I want them to be enthusiastic to learn and become competent engineers, but I always provide the support they need to succeed.

**CSM:** What are the teaching challenges facing academics in the 21<sup>st</sup> century?

**Anthony:** We have increasing government interference and a tendency to assess quality by what is easy to measure, even when that measurement may have little or misleading information within. As academics we need to be brave enough to push back and argue for effective student development, rather than meeting simple performance measures which often are improved by making the course 'easier' and less effective at preparing students for life. However, academics also need to be flexible, prepared to engage with both 21st century technology and the changing skills' needs of modern students, which means curricula and assessment methods must be constantly revised, updated and priorities/content changed.

**CSM:** You are the author of two books in the control field. What topics do these books cover?

**Anthony:** Both my books are on predictive control and the 2<sup>nd</sup> is a form of later edition of the first. In both cases, my aim was to produce a book that was different from the existing alternatives already available and give insights, derivations and algebra that are useful but often omitted elsewhere. Also, I wanted these to be books to learn from rather than simply reference material, so something a lecturer could base a MPC course around. Consequently I also provide all the source MATLAB code used to produce figures in the book so that students have working templates illustrating different concepts and algorithms they can play with and student problems throughout the text to encourage the reader to explore and understand the concepts as they go.

**CSM:** What are some of your research interests?

**Anthony:** In the early part of my career I spent a lot of time trying to understand the basic concepts of MPC, why it worked, when it worked, was it poorly defined and so vulnerable even when it seem to be working and so on? From this some interesting contributions have now become mainstream in the literature, such as the potential of the closed-loop paradigm for dual-mode control and mechanisms for ensuring constraint satisfaction under uncertainty while retaining reasonable computational complexity. More latterly I have been interested in the potential to apply MPC in a transparent and simple way to facilitate application to scenarios which are not exploiting the technology due to a perceived expense or complexity.

**CSM:** What are some of the most promising opportunities you see in the control field?

**Anthony:** The power of technology or computing has changed markedly over the past 20-30 years and this leads to some quite challenging questions for researchers and industrialists. If computing capacity is no longer a significant obstacle, can we deploy more sophisticated approaches to manage the world around us and at very cheap cost? Of course, a key obstacle is customer acceptance, maintenance and upfront design costs. As academics we spend a lot of time with students trying to get them to understand their engineering as opposed to memorizing mathematical routines so that they can be flexible, spot obvious errors and so forth and yet, such skills may be futile faced with a complicated algorithm embedded in a 5\$ micro-chip. So a key challenge is to exploit this computing power while retaining enough transparency so non-specialists can manage and modify the system safely day-to-day.

**CSM:** What are some of your interests and activities outside of your professional career?

**Anthony:** Outside of family, my main hobby is football. I am an active referee in local football looking after games most weekends over a range of ages from adult over 45 down to under 7s; all ages offer different challenges to game management and it is also pleasing to be able to facilitate an

enjoyable experience for all. I also coach an under 10s girls' team. We began as a team in 2017 with the girls having very few basic ball skills and it is really satisfying to see their progress and increasing enjoyment on match day as they play better and better.

### **Profile of Anthony Rossiter**

Current position: Academic in Department of Automatic Control and Systems Engineering, University of Sheffield, UK. Programme director for MENG Engineering.

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Experience highlights: Chair IFAC committee 9.4 and IEEE Technical Committee on Control Education (2017-). Created an undergraduate mathematics support service (MASH) at Sheffield. External examiner for undergraduate programmes at Reading, Portsmouth, Strathclyde and Glasgow Caledonian. International popularity of online Youtube site for teaching resources in modelling and control. Engineering faculty director of Learning and Teaching for 5 years. Seeing ideas you proposed in the literature being adopted by others.

Notable awards:

- University of Sheffield Senate award for sustained excellence in learning and teaching, 2009
- The Higher Education Academy Engineering Subject Centre Teaching Award 2008.
- Engineering Teaching prize from Royal academy of Engineering, 2005.
- Best paper awards from the Proceedings of the IEE, American Control Conference and Irish Systems and Control Conference.