Nonlinear Dynamics and Control of Engineering Systems

The real world is inherently nonlinear and in engineering systems nonlinearities arise from geometry, material properties and interactions between system components having nonlinear stiffness, damping and friction. Such nonlinearities frequently cause undesirable behaviour in engineering systems and structures, for example, instabilities, limit cycles or even chaos. In past few decades, nonlinear dynamics has rapidly developed and has a range of tools allowing a deeper insight of complex phenomena. Ultimately, by knowing the system responses, we want to direct it towards desired behaviour. This is part of control, which aims improving stability, refining performance, and optimizing effectiveness. Nonlinear control when used with nonlinear dynamics can be very efficient and has resulted in new control methods including delay feedback control and chaos control. The main advantage of nonlinear controllers is their simplicity; achieving a control goal may be simpler and more intuitive than for their linear counterparts. This statement comes from the fact that nonlinear controller designs are often deeply rooted in the physics of the controlled systems. Nonlinear control methods will take advantage of the given nonlinear system dynamics to generate high-performance designs.

In terms of applications, many useful nonlinear control systems have been established, ranging from modern planes without the pilot on board to drive-by-wire vehicles, to advanced robotic and space systems.

This mini-symposium aims to bring together researchers from academia and industry to examine the state-of-the-art in nonlinear engineering systems. The topics include but they are not limited to:

- Modelling and analysis of strongly nonlinear systems
- Stability, bifurcations and chaos in engineering systems
- Analytical, approximate and numerical methods of nonlinear dynamics
- Active and passive control of nonlinear systems.