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

Active Acoustic/ Elastic Matamaterials: Achieving Negative Density and Bulk Modulus

Speaker: Dr Simon Pope

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The University of Sheffield*

Wednesday, 20 February 2013 at 14:00

Location: Sir Henry Stephenson Building, Lecture Theatre LT02

ABSTRACT

The term “Metamaterial” has been in use since that start of the 21st Century and in the vision of the founding work is defined as “a material with properties which are not present in natural/conventional materials and these properties appear in a sub-wavelength domain”. The original work by the likes of Pendry and Smith was concerned with electromagnetic metamaterials where the properties of interest are the permittivity and permeability of a material. This pioneering work showed that a sub wavelength spaced array of particular local resonating structures can provide an overall homogeneous structure which can possess negative values for both the permittivity and permeability. This is an important result as all known natural and conventional materials possess positive values for these parameters in the low frequency regime. Interestingly when both of these parameters are negative the material exhibits several novel properties, such as a negative refractive index, reversed Doppler shift and opposing phase and group velocities. These novel properties have been linked with several high profile applications which have garnered substantial media interest, such as an invisibility cloak.

Later, due to the analogy between electrical and mechanical systems, acoustic/elastic metamaterials were born. In these materials the focus is on the density and modulus of the material and it has been shown that both of these can become negative in specific frequency bands. This seminar will introduce the field of elastic and acoustic metamaterials, but will subsequently focus on active metamaterials. Active metamaterials provide two important advantages when compared to passive metamaterials. The first is that the materials are tuneable and the second is that designs can be implement which cannot be realised using passive materials. It is aimed as an introduction to the field and will highlight the work in the Department of Automatic Control and Systems Engineering and contributions which Control and Systems Engineers can make.