Department of Automatic Control & Systems Engineering
would like to announce the following seminar:

Localisation in Wireless Networks Using Monte Carlo Methods

Speaker: **Dr Mila Mihaylova**

Lancaster University, Department of Communication Systems

Wednesday 15th November 2006
at 14:10

Location: Sir Henry Stephenson Building LT1
Coffee and Biscuits will be served afterwards.

ABSTRACT

This talk will present recent results on localisation in wireless sensor networks based on Monte Carlo methods. The first problem concerns the localisation (tracking) of a mobile user based on data from wireless cellular networks. This is a key challenge that has been recently investigated both from theoretical and practical point of view. Depending on the measurements, e.g., received signal strength indicators (RSSI), time of arrivals (TOA), time difference of arrival (TDOA), etc, different methods have been developed in the literature.

We propose two solutions to the mobility tracking problem using the Monte Carlo method. We formulate mobility tracking as an estimation problem of *hybrid systems* which are systems with a base state vector and a mode (modal) state vector. The base states are continuously evolving, whilst the modal states can undergo abrupt changes. A particle filter (PF) and a Rao-Blackwellised particle filter (RBPF) are developed where the measurements are RSSI from neighbouring base stations. The algorithms' performance is evaluated and validated by experiments with real and simulated data in terms of complexity and accuracy. Posterior Cramér-Rao Lower bounds are calculated that characterise the best achievable filters' performance.

The second part of the talk will consider a problem related to the localisation in cellular networks, namely the localisation of mobile nodes in ad hoc wireless networks. The problem considered consists of estimating the unknown positions of moving sensor nodes, based on RSSI. The same system and measurement models are used as in the case with the cellular networks. Node mobility is modelled as a linear system driven by a discrete-time command Markov process. Localisation of the mobile nodes is performed via an Interacting Multiple Model Filter consisting of a bank of Unscented Kalman Filters (IMM-UKF).. The performance of the IMM-UKF is compared with a multiple model particle filter (MM PF) by Monte Carlo simulations in terms of complexity and accuracy. Posterior Cramér-Rao Lower bounds are calculated.