Use of System Dynamics in Maintenance Modelling  
*Prof. Khairy Kobbacy*

The model presented here to represent a system is viewed as one which exists in discrete states each having its own failure profile with the rate of change determined by a decay process. The use of the system dynamics methodology to model this approach is presented with two different methods used to quantify the effects of preventive maintenance. The use of feedback to determine the system behaviour is illustrated.

Robust Design  
*Prof. Michael Beer*

Structural robustness is of increasing interest in engineering to cope with hazards, risk, and uncertainty. We have to ensure a proper behaviour of the structure despite uncertainty of structural and environmental parameters. Further, changes of design parameters should not have dramatic effects. To achieve these goals, structural robustness needs to be incorporated as an objective in the design process. This requirement is addressed with a non-traditional concept and numerical approach, which can be applied in combination with nonlinear structural analysis and which can utilize simulation results from any initial uncertainty analysis, such as Monte Carlo simulation, interval analysis or fuzzy analysis.

Some New Survival Distributions  
*Prof. Rose Baker*

New survival distributions have been derived in two ways. One is by considering a class of distributions based on Johnson’s arcsinh transformation. Besides a \(t\)-like distribution, this yields a Pareto-like distribution, but one that is exponential until later in the tail. The second approach is based on the Frullani integral, and yields long-tailed versions of familiar distributions such as the Weibull. It will be interesting to hear feedback on the potential usefulness of these distributions in reliability.

Asset Management for Electricity Networks  
*Dr Andrew Brint*

Concerns about the low level of renewal of electricity and other infrastructure networks, have been expressed for many years and continue to be raised. The fear is that delaying investment has limited short term impact but stores up problems for the future. A central difficulty lies with the data that is available as the condition information is often coarse and failures may be infrequent. Several techniques have been proposed for long term Asset Management planning, but only some have had a practical impact. Besides discussing these areas, consideration will also be given as to how the modelling could be improved.

Maintenance Policies for Systems that Feature Bivariate Failure Processes  
*Prof. Phil Scarf*

Two models that feature bivariate failure processes are discussed. They are motivated by railway maintenance planning. The first concerns the power switch of a traction motor which we model as a two-component system with dependent lifetimes. The second concerns rolling stock which we model as a complex system subject to hard and soft failure processes with intensities that are related. Our purpose is to investigate the effect of dependency upon optimum policy.
Marine and Offshore Safety Analysis  
**Prof. Jin Wang**

This presentation will briefly describe maritime risk and security assessments. Particular reference will be directed to application of some mathematical techniques for facilitating maritime risk and security assessments under uncertainties in data. Examples of such mathematical techniques include fuzzy set theory, an evidential reasoning method, Bayesian networks and delay time concept. Emphasis is placed on the application side with respect to maritime engineering systems.

Structural Health Monitoring for Aerospace Systems and Structures  
**Prof. Keith Worden**

Structural Health Monitoring (SHM) is the discipline concerned with diagnosing damage in structures or systems on the basis of measured data. It is naturally framed in terms of pattern recognition or machine learning whereby one uses data from the structure to train detectors, or classifiers that can also potentially locate and characterise damage. When SHM is carried out by using change detection, it is necessary to derive diagnostics which are robust against false alarms caused by benign environmental or operational variations. This is one of the main problems in data-based SHM. Robustness problems also arise in the context of SHM in terms of how well data-based algorithms generalise between situations. Both aspects of SHM will be covered in the presentation.

Reliability Models for Parallel-Series Systems  
**Mr Safar Al-Ghamdi**

We investigate the equivalence factors of reduction and duplication methods for improving system reliability. The context is a parallel-series system where \(n\) subsystems, each comprising \(m\) components, are connected in series. All components are assumed independent with the same generalized quadratic failure rate distribution.

Degradation Modelling and Residual Life Estimation  
**Ms Wenjia Xu**

We propose a model to predict the residual useful life of a component by condition monitoring. An adaptive gamma process is used to describe the deteriorating nature of the observed condition indicator but one of the parameters of the gamma model is updated whenever a new observation of the indicator becomes available.

Minimal Repair in Two Dimensions  
**Mr Stuart Bell**

The two-dimensional renewal theory of Hunter (1977) is well established in the warranty and repairable system literature. More recently, developments have been made toward a theory for a two-dimensional minimal repair process. We review this theory providing alternative expressions for a number of key formulae.

Review and Future Plans  
**Prof. Frank Coolen, Prof. John Quigley, Dr Keming Yu, Prof. Dave Percy**

This meeting is part of a joint research group on Mathematical Methods in Reliability, involving Durham, Strathclyde, Brunel and Salford Universities and sponsored by a Scheme 3 grant from the London Mathematical Society. For more information about related events see: http://maths.dur.ac.uk/stats/people/fc/LMS-Reliability.html