Plant Reliability Modelling, Analysis And Prediction

Introduction:

High plant reliability is critical for every successful company, and it has never been more important than it is in the present economic climate.

The costs associated with equipment downtime and reduced production can be significant, and engineers must ensure that you are using every possible means of maximising plant reliability and performance. Of the five fundamental ways in which engineers can approach the maintenance of plant, one of the least commonly used (because it is least commonly understood) is Reliability Centred Maintenance (RCM).

The heart of an RCM approach is the creation and exploitation of reliability models which use previous failure data to predict future plant performance and hence permit the selection of a maintenance strategy and frequency optimisation of planned maintenance activities. Reliability modelling as part of an integrated maintenance strategy is an approach that can no longer be sidelined or ignored by high performing companies.

This programme is a combination of instructor-led topic areas and extensive computer-based analysis and modelling. You will learn in detail about, and practice using, best-of-breed approaches to statistical failure data analysis and reliability modelling. Furthermore, throughout the programme you will have the opportunity to analyse your own data and to ask lots of questions about how best to apply reliability analysis and modelling techniques in your organisation.

The programme delivers many practically-based technical solutions to reliability improvement, and delegates will

discuss these concepts and practice using them via a range of practical tools applied to real-world case studies and data.

Who Should Attend?

It is highly recommended to Reliability Engineers, Maintenance Planners, Maintenance Supervisors and Maintenance Engineers

Pre-Requisite:

This is a specialist analytical and modelling programme that is designed for specialists in technical maintenance. It involves extensive statistical analysis and data modelling methods. Attendees need to be computer literate, familiar with and competent at using Microsoft Excel, and must have technical backgrounds, ideally to degree standard in an engineering or related technical subject.

Course Objectives:

- Explore and understand the power contained in maintenance history records (failure data), and how this can be harnessed using statistical approaches to improve maintenance (and hence overall plant) performance
- Analyse failure data using a range of first principles and industry standard methods, all implemented in Microsoft Excel
- Understand failure mode shape analysis and thereafter to extract failure mode shapes from history record data and use this to optimise Planned Maintenance (PM) activities
- Understand the theory and application of reliability modelling
- Apply the theory of reliability modelling to a range of practical case studies, using the teaching version of an industry standard reliability modelling software package
- Develop from first principles a practical and comprehensive reliability modelling and statistical analysis toolbox in Microsoft Excel, and use this to analyse numerous practical case studies
- Use reliability models to predict future spare parts requirements and the proportions of maintenance time that will be spent in reactive (breakdown) and proactive (PM/PPM) maintenance activities

- Explore the implementation of a Reliability Centred Maintenance approach as part of a modern maintenance management strategy, including a detailed cost-benefits analysis of a real application

Course Outline:

DAY 1 - Maintenance strategies and the power of historical data

- Fundamental approaches to maintenance
- Formulating a maintenance strategy
- The importance of maintenance history records
- Understanding plant performance
- An introduction to the statistical analysis of failure data
- The principles of failure data analysis
- Industry standard measures of reliability (Availability, MTBF, MTTR, etc)
- Extensive hands-on experience
- Open discussion

DAY 2 - Statistical analysis of failure data

- Pareto analysis, rank order charts and standard deviation
- Linear regression models and determining model accuracy
- Failure mode analysis
- Interpreting failure mode shapes
- Extracting failure mode shapes from real data
- Optimising PM activity using mode shape analysis
- Knowing when to use a breakdown maintenance approach
- Extensive hands-on experience
- Open discussion

DAY 3 - Reliability models and approaches to modelling

- The principles of RCM and reliability modelling
- Developing a reliability model
- Weibull statistics and the range of Weibull models (2 parameter, 3 parameter, maximum likelihood, maximum accuracy)
- The Weibull curve and plotting data on a Weibull scale
- Defining parameters: shape, scale, mean life, minimum life, characteristic life, standard deviation
- Model accuracy assessment (observed model accuracy and hypothesis rejection)
- Interpreting model results
- Confidence levels and Weibull critical values
- Key graphical functions:
    - ❖ The reliability function: survival probability
    - ❖ The cumulative distribution function
    - ❖ The failure probability density function
    - ❖ The failure rate function
- Extensive hands-on experience
- Open discussion

DAY 4 - Cost based maintenance and the basis of a reliability toolbox

- Converting reliability model data into cost based maintenance decisions
- Optimising PM activity based on cost and by using reliability predictions (note that the programme will NOT cover the costing of maintenance activities, but will assume that this information is already known)
- Calculating the cheapest PM interval for age-based replacement policies
- Graphing costs versus PM interval
- Predicting future failures
- Predicting spares utilisation
- Development of the key components of a reliability toolbox
- Extensive hands-on experience
- Open discussion

DAY 5 - The finalisation of a comprehensive reliability toolbox in Excel

- The cost of maintenance convenience and making informed maintenance optimisation decisions
- Incorporating real world effects within reliability models
- Specifying the PM interval and understanding the implications of doing this
- Completing the reliability toolbox
- Graphing toolbox results
- Toolbox testing and comparison of results with best-of-breed modelling software
- Extensive hands-on experience
- Overall review of concepts learned and how they can be applied in practice