Module Name:	**Advanced Lifing Correlations**
Module Code:	**EGTM00**
Presenter(s):	**Professor John Evans/Mr Steve Williams (Rolls-Royce plc)**
Credit Rating:	**10**
Venue:	**College of Engineering, Swansea University**

Synopsis:

The fatigue process can be simplified into two main stages; the initiation of a crack through cyclic "damage" followed by the growth of that crack to some critical size to instigate an overload failure. This module will focus on the strain based failure criteria and the use of mathematical methods for correlating total fatigue data. Theoretical approaches to strain based lifing will be complimented by industrial case studies.

Intended Outcomes:

On completion of the module students will demonstrate:

- Awareness of strain based relationships for quantifying the initiation response of engineering cracks in components
- Familiarity with numerical techniques for handling mean stress effects including the Goodman diagram and Walker relationship
- Appreciation of the critical importance of stress concentration features in the initiation of cracks
- Understanding the techniques available for predicting fatigue crack initiation at notches and other design features in components
- Awareness of complex variables influencing fatigue response, including biaxial stress fields and critically stressed areas/volumes
- Evaluation of the statistical nature of fatigue and the derivation of scatter factors for establishing component safe cyclic lives.
- Derivation of constitutive parameters to describe material performance and analysis of stress/strain loop information.

Module Aims:

To understand the fundamental damage mechanisms that lead to crack initiation and ultimate failure in structural metals and to apply mathematical techniques to predict the cyclic performance of engineering components in service environments.

Syllabus:

The module will focus on the following issues:

- Definitions and characteristic features of low and high cycle fatigue.
- Quantification of fatigue performance in relation to stress and strain controlled loading states.
- Hysteresis loop generation and the derivation of cyclic stress - strain curves.
- The kinetics of crack growth after the initiation of a fatigue crack.
- The major impact of stress concentration features and their quantification.
- The impact of surface finish and residual stresses on fatigue performance.
- The application of advanced life prediction techniques in the establishment of a total life for components encompassing both crack initiation and subsequent propagation to failure.
- Variability in fatigue and the use of statistical methods in the construction of design codes.
- A detailed overview of this new lifing approach as it is applied to gas turbine components.
- Demonstration of the principles covered through worked examples and case studies.

Assessment:

5,000 word assignment to be submitted within three weeks, after the course presentation