

## An Introduction into Thermo-Mechanical Fatigue

*Swansea Materials Research & Testing (SMaRT)* will present a 3 day course on Thermo-Mechanical Fatigue (TMF) at the Institute of Structural Materials, Bay Campus, Swansea University, 20-22 of November 2017.

***Course fee - £500, lunch will be provided on each of the three days. Accommodation is not included***

It is widely acknowledged that thermo-mechanical fatigue (TMF) offers one of the most significant technological challenges facing the gas turbine, power generation and transportation sectors. In particular, designers need to take into account formidable emissions and efficiency targets over the coming years. Previous lifing methods applied to safety critical components experiencing TMF have proven to be non-conservative when such predictions were based solely on isothermal mechanical property data. When TMF testing has been incorporated, misleading experimental techniques have often led to unreliable data, ultimately requiring the incorporation of overly cautious safety factors into the lifing calculation.

The Institute of Structural Materials is recognised by Swansea University as a “Major Research Facility”, where commercial materials testing and academic interpretation come together under one roof. SMaRT provides a suite of world class TMF facilities, with four test rigs currently operational, covering specific equipment configurations developed to support a range of low cycle fatigue and crack propagation test requirements under thermal cycling.

The course will provide an introduction to TMF test techniques and data analysis through a structured learning environment, incorporating presentations, shared discussion and practical demonstrations. A basic understanding of mechanical testing will be assumed.

The course objectives include:-

- i) A detailed understanding of the nature of TMF problems in service
- ii) Interpretation of the International TMF test standard ISO12111
- iii) Hands on experience of mechanical test methods for TMF
- iv) Approaches to data analysis of TMF tests
- v) Understanding of the test data

The course is supported by three members of the ISM academic team at Swansea University:-

- ***Dr Mark Whittaker*** is an Associate Professor in the Institute of Structural Materials at Swansea University. He has published over 40 papers in refereed international journals in such areas as high temperature lifing, nickel based superalloys and thermo-mechanical fatigue. He is a Chartered Engineer and member of the organising committee for a number of major International conferences (Fatigue 2017, Fatigue Damage in Structural Materials XI, Creep 2017). He has a strong publication record in TMF and is actively involved in the TMF community where Swansea are a partner on development of a code of practice for Stress Controlled TMF. He has supervised PhD/EngD projects to successful completion in the area of TMF, with further students actively pursuing TMF research.
- ***Dr Robert Lancaster*** is a Senior Lecturer in the Institute of Structural Materials, part of Swansea University’s College of Engineering. His research portfolio encompasses a comprehensive understanding of thermo-mechanical fatigue (TMF) for gas turbine applications with an emphasis on simulating the arduous in-service conditions in a research laboratory. This research has generated several key journal publications and presentations at prestigious International conferences which have since attracted considerable further investment into the SMaRT TMF capabilities, with funding secured from national and international research councils and numerous industrial sources. Dr. Lancaster is also a key component of Swansea University’s TMF research team pioneering the use of non-invasive temperature measurement and helping to shape the forthcoming standardisation of TMF stress control testing.
- ***Dr Jonathan Jones*** is a Postdoctoral Research Officer in the Institute of Structural Materials at Swansea University. In 2016 he received a PhD for his research into phase angle effects in an advanced nickel superalloy under TMF loading, coupled with significant advances in temperature control methods for TMF experiments. He is a member of the British Standards Institute for ISE/101/6, specialising in non-contact temperature measurement and control technique development.

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