DEPARTMENT OF ENGINEERING SCIENCE

Job description and selection criteria

Job title	Research Assistant in Materials Engineering
Division	Mathematical, Physical and Life Sciences Division
Department	Engineering Science
Location	Central Oxford
Grade and salary	Grade 7: £29099-£35788 per annum
Hours	Full time
Contract type	Fixed-term for up to 2 years
Reporting to	Professor Alan Cocks
Vacancy reference	102055
Additional information	

Introduction

The University

The University of Oxford is a complex and stimulating organisation, which enjoys an international reputation as a world-class centre of excellence in research and teaching. It employs over 10,000 staff and has a student population of over 21,000.

Most staff are directly appointed and managed by one of the University's 130 departments or other units within a highly devolved operational structure - this includes 5,900 'academic-related' staff (postgraduate research, computing, senior library, and administrative staff) and 2,820 'support' staff (including clerical, library, technical, and manual staff). There are also over 1,600 academic staff (professors, readers, lecturers), whose appointments are in the main overseen by a combination of broader divisional and local faculty board/departmental

structures. Academics are generally all also employed by one of the 38 constituent colleges of the University as well as by the central University itself.

Our annual income in 2009/10 was £879.8m. Oxford is one of Europe's most innovative and entrepreneurial universities: income from external research contracts exceeds £367m p.a., and more than 60 spin-off companies have been created.

For more information please visit

http://www.ox.ac.uk

The Mathematical, Physical, and Life Sciences Division

The Mathematical, Physical, and Life Sciences Division (MPLS) is one of the four academic divisions of the University.

Oxford is widely recognised as one of the world's leading science universities. In the 2008 UK Research Assessment Exercise over 70% of research activity in MPLS was judged to be world-leading (4*) or internationally excellent (3*), and Oxford was ranked first in the UK across the mathematical sciences as a whole.

The MPLS division's ten departments and three interdisciplinary units span the full spectrum of the mathematical, computational, physical, engineering and life sciences, and undertake both fundamental research and cutting-edge applied work. We have over 6,000 students and research staff, and generate over half of our funding from external research grants. Our research addresses major societal and technological challenges and is increasingly interdisciplinary in nature. We collaborate closely with colleagues in Oxford across the medical sciences, social sciences and humanities, as well as with researchers from around the world.

For more information, please visit:

http://www.mpls.ox.ac.uk/

Engineering Science Department

Engineering teaching and research takes place at Oxford in a unified Department of Engineering Science whose academic staff are committed to a common engineering foundation as well as to advanced work in their own specialities which include most branches of the subject. We have especially strong links with computing, materials science, medicine and also with economics and management studies. The Department employs over 70 academic staff (this number includes ten statutory Professors appointed in the main branches of the discipline, and 24 other professors in the Department); in addition there are 9 Visiting Professors. There is an experienced team of teaching support staff, clerical staff and technicians. The Department has well-equipped laboratories and workshops, which together with offices, lecture theatres, library and other facilities have a net floor area of about 16,000 square metres.

Teaching

We aim to admit 160-180 undergraduates per year, all of whom take 4-year courses leading to the MEng degree. Around 80% of the undergraduates read the broadly-based Engineering Science course. The remainder study for a joint degree in Engineering, Economics and

Management. The courses are accredited at MEng level by the major engineering institutions. The syllabus has a common core extending through the first two years. Specialist options are introduced in the third year, and the fourth year includes further specialist material and a major project.

Research

Research in the Department is particularly strong. We have approximately 280 research students and about 80 Research Fellows and Postdoctoral researchers. Direct funding of research grants and contracts, from a variety of sources, amounts to an annual turnover of approximately £10M in addition to general turnover of about £12M. The Department achieved the highest grade (5*A) in the 1996 and 2001 Research Assessment Exercises. In the Research Assessment Exercise of 2008, 85% of the Department's research was rated as 4* or 3* (world-leading or internationally excellent). The research activities of the department fall into seven broad headings, though there is much overlapping in practice: Turbomachinery; Materials Engineering; Civil and Offshore; Information, Control and Vision; Electrical and Optoelectronic; Chemical and Process; Biomedical Engineering.

For more information please visit:

http://www.eng.ox.ac.uk/

Solid Mechanics and Materials Engineering

The successful candidate will join the Solid Mechanics and Materials Engineering Group. The Group is one of the largest research groups within the department. It currently includes nine members of academic staff: Professors Alan Cocks, David Hills, David Nowell, Paul Buckley, Alexander Korsunsky, and Fionn Dunne and Drs Nik Petrinic, John Huber, and Clive Siviour. Professor Cocks holds the Professorship of Materials Engineering and acts as head of the group. The group contains the Rolls-Royce UTC in Solid Mechanics under the Directorship of Professor Hills. The total turnover of the group is in excess of £2m per annum. Our research activities are supported by five technicians, an administrator and a computing support officer. These people, together with the academic staff, form the stable core of the group's personnel. In addition, there are about forty research students, research assistants, post-doctoral assistants and academic visitors, most of whom have a typical association of three to four years.

The group conducts research across a wide range of areas within Solid Mechanics and Materials Engineering. We have extensive laboratory facilities in the centre of Oxford and in Begbroke on the outskirts of the city for testing materials and components across a range of environmental conditions and strain-rates. A major theme of our research is to develop an in-depth understanding of the processing and performance of engineering materials by integrating experiment, theory and computational modelling. Much of our research is relevant to the long-term needs of industry and we have particularly strong links with the aerospace, automotive, defence, energy and marine sectors.

Further details of the group's research activities may be found on the group website (**http://www.eng.ox.ac.uk/solidmech/home/Home.html**).

Job description

Research topic	Development of a micro simulation model for predicting the number density of creep voids in steel welds
Principal Investigator / supervisor	Professor Alan Cocks
Project team	
Project web site	(**http://www.eng.ox.ac.uk/solidmech/home/Home.html**)
Funding partner	The funds supporting this research project are provided by Mitsubishi Heavy Industry
Recent publications	
Technical skills	Materials and computational modelling

Overview of the role

The overall objective of this project is to develop a model which simulates the evolution of creep damage in the form of voids and cracks in the heat affected zone of a weld. The model will be developed from an in-depth evaluation of experimental data and micromechanical models of cavity nucleation, growth and coalescence. The model will be coupled with Finite Element models of welded components, which will provide detailed information about stress state and stress history during in-service exposure. The Research Assistant appointed to this post will be responsible for the development of the model and its integration with the commercial finite element code ABAQUS, under the guidance and supervision of Professor Alan Cocks. The project is sponsored by Mitsubishi Heavy Industries (MHI). Regular reports will need to be made on the progress of the project to MHI.

The main tasks will be:

1. Evaluation of existing data on microstructure, damage development and failure of welded components for 2.25Cr-1Mo steel and modified 9Cr-1Mo steel during mechanical loading at temperatures in the creep regime. This will include data provided by MHI and data available in the open scientific literature.

2. Review existing micromechanical and phenomenological models of cavity nucleation, growth and coalescence and evaluate their ability to capture and model the phenomena observed experimentally.

3. Development of 2-D models which extend the concepts outlined by Kawashima et al (] F. Kawashima, T. Igari, T. Tokiyoshi, A. Shiibashi and N. Tada, Micro-macro combined simulation of the damage progress in low-alloy steel welds subjected to Type IV creep failure, JSME International Journal, 47-3, pp.410-418, 2004). These

will be based on regular and random grain structures; they will consider the deformation of the grains and grain boundary regions, grain-boundary sliding and incorporate models for cavity nucleation, growth and coalescence. These models will take into account multiaxial states of stress. They will be guided by and calibrated against experimental data.

4. Evaluation the coupling of the polycrystalline model with macroscopic finite element simulation of the stress distribution in a welded component. The models will be implemented in ABAQUS, and the validity of the simulation to an elbow subject to internal pressure will be demonstrated.

5. Write 6 monthly reports for the external sponsor.

Key responsibilities:

Manage own academic research and administrative activities. This involves small scale project management, to co-ordinate multiple aspects of work to meet deadlines

Undertake comprehensive and systematic literature reviews and write up the results for external sponsor and for publication in peer-reviewed journals

Evaluate available experimental data of damage development in weld HAZs

Assess existing micromechanical models of cavity nucleation and growth and evaluate their ability to model the observed experimental behaviour

Develop models for the growth of damage in welded components which can predict the evolution of the density of creep cavities during temperature and loading histories experienced in-service.

Integrate the developed model with the finite element code ABAQUS

Write reports for external sponsor and papers for publication

Represent the research group at external meetings/seminars, either with other members of the group or alone

Actively participate in group meetings

Selection criteria

Essential

- Hold (or be near to completion of) a relevant PhD/DPhil, together with relevant experience

- Experience of developing models for the behaviour of engineering materials

- Ability to evaluate and interpret experimental data to inform the modelling activity

- Experience of numerical modelling using Finite Element software such as ABAQUS

- A track record of oral/written communication of scientific research
- A track record of publication of scientific research
- Ability to work independently and to interact effectively with other research staff and senior academics
- Good communication skills

Desirable

- Experience of modelling the creep behaviour of engineering materials
- Experience of writing code or user routines for finite element analysis

Working at the University of Oxford

For further information about working at Oxford, please see: http://www.ox.ac.uk/about_the_university/jobs/research/

http://www.ox.ac.uk/about_the_university/jobs/professionalandmanagement/

http://www.ox.ac.uk/about_the_university/jobs/supportandtechnical/

How to apply

If you consider that you meet the selection criteria, click on the **Apply Now** button on the 'Job Details' page and follow the on-screen instructions to register as a user. You will then be required to complete a number of screens with your application details, relating to your skills and experience. When prompted, please provide details of two referees and indicate whether we can contact them at this stage. You will also be required to upload a CV and supporting statement. The supporting statement should describe what you have been doing over at least the last 10 years. This may have been employment, education, or you may have taken time away from these activities in order to raise a family, care for a dependant, or travel for example. Your application will be judged solely on the basis of how you demonstrate that that you meet the selection criteria outlined above and we are happy to consider evidence of transferable skills or experience which you may have gained outside the context of paid employment or education.

Please save all uploaded documents to show your name and the document type.

All applications must be received by **midday** on the closing date stated in the online advertisement.

Should you experience any difficulties using the online application system, please email recruitment.support@admin.ox.ac.uk

To return to the online application at any stage, please click on the following link www.recruit.ox.ac.uk

Please note that you will be notified of the progress of your application by automatic e-mails from our e-recruitment system. **Please check your spam/junk mail** regularly to ensure that you receive all e-mails.