Welded joints behaviour in high temperature reactor

University of Bristol
Academic Supervisor: Professor Chris Truman
Industrial Supervisor: Professor David Dean (EDF Nuclear Generation)

Welded joints are one of most safety critical locations in a reactor structure. They are often prone to damage after decades of operation and can be considered to be one of the life-limiting factors in the UK's advanced gas cooled reactors. This is because of the complexities involved in a weld including the residuals stress, varying microstructure and their complicated geometry. The aim of this project is to identify the criticality of the stress concentration created at the interface of a welded joint through advanced experimental techniques such as Digital Image Correlation and synchrotron X-ray diffraction. The experimental work is expected to be complemented by finite element simulations to assess the severity of the creep damage accumulated at the weld interface. Critically, the key results are expected to be included in the integrity assessment procedures the engineers use day to day to evaluate the fitness for service of reactor components. The studentships offer an excellent platform for future career opportunities our alumni have top level jobs at nuclear industry companies.

The work will be carried out in a newly modernised well-equipped high temperature mechanical testing facility at University of Bristol in collaboration with experts at EDF Energy and other researchers in The Solid Mechanics Research Group (SMRG). SMRG is also a regular user of UK major facilities such and Diamond Light Source and ISIS Neutron and Muon Source.

Based in the Department of Mechanical Engineering at University of Bristol (UoB), SMRG focusses on industrially-relevant research in support of low carbon energy sector in the UK. Since 2008 SMRG has had research partnership with EDF Energy, who are responsible for operating the existing fleet of UK nuclear power plants. The research has recently expanded to close collaboration with UK Atomic Energy Agency (UKAEA) at Culham Centre for Fusion Energy. This has broadened the facilities and SMRG's structural integrity activities to include fusion as well as fission. SMRG currently has eight academic staff and approximately 20 students and research staff.