CreepImage - Development of a long term creep monitoring image based technique

The ever increasing demand for low-cost energy is forcing many of our power stations to run well beyond their original design life. In the past, ill-informed decisions have resulted in failures of superheated steam pipes with serious consequences such as power cuts, financial losses and risks to human life.

The safe extension of a power station's operating life requires new inspection techniques which must accurately detect creep damage and predict the remaining life of a component. CreepImage, a project run by a group of European companies, is developing an optical inspection technique for long-term monitoring of creep deformation in engineering structures.

Figure 1 Rapid CreepImage inspection performed using a camera positioning jig.

Project objectives

- to develop a methodology to apply a high temperature resistant speckle pattern to the test piece
- to develop an algorithm to monitor creep strain via non-intrusive measurements
- to develop a prognosis methodology to evaluate the remaining life of component based on surface creep strain measurement
- to integrate the whole system and carry out field trials to validate the technique
- to develop a creep monitoring protocol for the power generation industry.

Achievements

Digital camera equipped with a telecentric lens has been integrated into a compact prototype system with a three-leg based positioning mechanism, which allows quick deployment on a power plant pipe. A protective casing for the inspection coupon was also designed and trial installed on an ex-service pipe. A micro laser cladding procedure was formulated to produce a high-density grid pattern on the inspection coupon. A remaining life prognosis method based on the Omega model was incorporated into the system.

Extensive trials of the CreepImage system have been performed, which include power plant field testing to assess the usability; ambient temperature tests to determine strain measurements stability and repeatability, and a high-temperature creep test to determine strain measurement capability.

A comprehensive analysis of the accelerated creep test data obtained from Inconel 625 clad P91 ex-service specimens and virgin SS316 specimens has been performed. For the SS316 accelerated creep test, good correlation was observed between the creep strain results obtained using the CreepImage system and those calculated from the elongation data recorded by the extensometers. Consequently, it was demonstrated that the CreepImage system is capable of providing highly accurate creep strain measurements.

For further information, please visit the project website at **www.creepimage.eu**

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