1. Theoretical Background and the Linear Matching Method

1.1 Bree diagram with responses to cyclic loading

1.2 Fundamentals of the Linear Matching Method

- belongs to the group of multiaxial elastic-plastic methods with the following key assumptions:
  - with each step involves the solution of a linear problem;
  - each solution satisfies the condition of static equilibrium;
  - linear elastic constitutive assumptions are imposed sequentially;
  - data are sequentially positive, decreasing and non-divergent.

- method does not take into account static dissipative effects of work;
- gives elastic solution for the solution of the elastic-plastic problem;
- generates structural stresses at the solution of the elastic-plastic problem;
- generates elastic solution for the solution of the elastic-plastic problem;
- generates an elastic solution for the solution of the elastic-plastic problem.

Algorithms at the LMM:
- Linear Elastic-Fracture Mechanics - LEM Procedure, ASME Section XI and RO-MAR (1978) - typically based on yielding by Yavin;
- Constitutive-LM Algorithm (CFA) - with transient strain rate;
- Linear Elastic Fracture Mechanics Analysis (LEMA) incorporated into ABAQUS;
- ELLAMM - Elastic-Strain Analysis (Wong et al., 2004);
- ELLAMM - Elastic-Strain Analysis (Wong et al., 2004);
- ELLAMM - Elastic-Strain Analysis (Wong et al., 2004).

Development of the LMM Framework:
- Modified Multiaxial Method (Mismail, 2002, 2003) - with transient strain rate (Fatemi, 2000);
- Modified Multiaxial Method (Mismail, 2002, 2003) - with transient strain rate (Fatemi, 2000);

2. Testing & modelling of cruciform weldment

2.1 Experimental facility and specimen with typical failures

2.2 Dimensions (mm) of the cruciform weldment specimen

3. Properties of the steel AISI type 316(L) at 550°C

3.1 Rate-independent cyclic plasticity

3.2 Creep strain and rupture

4. Creep-Fatigue Evaluation Procedure

4.1 Creep-fatigue evaluation procedure with time fraction rule

4.2 FEALMM results corresponding to \( \Delta \varepsilon = 1 \% \) and \( \Delta t = 5 h \)

4.3 Creep-fatigue evaluation results of the cruciform weldment

5. Analysis of the Obtained Results

5.1 Analytical functions for cycles to failure and residual life

5.2 Design contour plot for creep-fatigue durability

5.3 Comparison of the observed and predicted \( N^* \)

5.4 Dependence of FSR\( F \) on duration of dwell period \( \Delta \tau \)

6. Conclusions

- The authors deeply appreciate the EPSRC for the financial support in the form of fellowship grants.
- The EPSRC are the main funder of the project.
- The work was conducted within the EPSRC Centre for Doctoral Training in Engineering for Cyber-Physical Systems and the EPSRC Centre for Doctoral Training in Engineering for Cyber-Physical Systems.
- The project is funded by EPSRC grant EP/N510215/1.
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