Minutes of FD&E Life Prediction Sub-Committee

Chairman: Chin-Chan Chu

1. Request for comments on previous minutes?
None.

2. Technical talk No. 1

Ric Leist, Cessna: Report on Task Group Activity

i) Mission Statement
-Increase Confidence in Damage Tolerace Analysis
-Provide a Forum
-Improve awareness
ii) Distribution list
iii) Topic List:
-Basic Verification
-Beta or Shape Factor in Delta_K
Organizational meeting on Monday (apr 2):
-Cracks at holes would be good to verify
-Differences between various codes
What to do right now:
1. Identify geometry of cracks & holes
2. Collect SI factors, solutions
3. Evaluate factors
4. Select case histories
5. Apply solutions to case histories.
We would rather not use odd nuclear steels - (prefer aircraft or ground vehicle materials.

Q & A defered to next day session

3. Ralph Stephens, U.of Iowa: Report on Mean Stress Effects
Stephens, Vantiger, Karadag, "The Influence of High Tensile Mean Stress on Fatigue of Smooth & Notched SAE1045 Stee,"
Vaniger did the notched samples
Karadag did the smooth spec. tests.
Objective:
a) Smooth
b) Notched Kt=1.65 (Circumferential on bar sample)
c) Rc= 10, 37, 50
d) R= 0.8 and 0.9

Correlate SN, Strain-life, Alternating (?)

Macro and Microscopy

Tensile curves: Rc10 Syield= 700 MPa
Rc37 =1200 Mpa
Rc50 =2450(?) Mpa

Notched strength ultimates were quoted.

Fatigue tests had "flat" curves, and thus were very sensitive to Smax. For R=0.8 curves were less flat.
Other data (1962 literature) also had very flat curves for R=0.9, 0.8

Common S-N models do not work.
In the discussion it was suggested that diametral strain be measured in the notched samples, and that the Bridgeman correction factors be applied

4. C.-C. Chu, Ford Mo.Co.: High Mean Stress Project
Ms. Chu stated that Russ Chernenkoff would report on the test details at the next meeting. In the interim she showed the test results of (a) high tensile and (b)"low" compressive mean stress tests.
Type (a) tests all had the same high Smax, with various Smin values (one per test).
Similarly type (b) had the same low Smin value, but varied the Smax value from test to test.

Data is posted on the web:
http://fde.uwaterloo.ca/Fde/Highs0/racccc.html

Raw fatigue data for this SAE1045 normalized steel (termed "Phase II") by the F.D.& E. committee can be found at:
http://fde.uwaterloo.ca/Fde/Materials/Steel/steel.html

5. _____, Magna S-D-P: "Computer Simulation of Stiffness...
a) Introduction to finite element approximation for spot welds used in the past: Co-incident nodes, ridgid beam, very detailed mode, and a German university special arrangement that allows reasonable element arrangement.

b)The latter method uses a remesh (20min for 200K elem, 2K spot welds, on a medium workstation. Total run 8 hours.

c)Good correlation with Floor model.

d)Predictions also good for gear box bench and rear door.

e)Future:
- Fat. Life Pred. of mechanical joining technologies
- New processing features, CAD-data conversion
- Interface to deep draw simulation

f)Conclusions:

- Remesh for spot welds gives better stiffness & stresses
- good prediction
- problems with non-linear sheet contact
- Verification of life for BIW is difficult (hard to find cracks on test fixture or rig)
- Mechanical joining will become more important.

Q & A :

Mech. joining = riveting

Riveting will come soon in steel cars too

Audi A2 is 50% rivets + laser mig welding