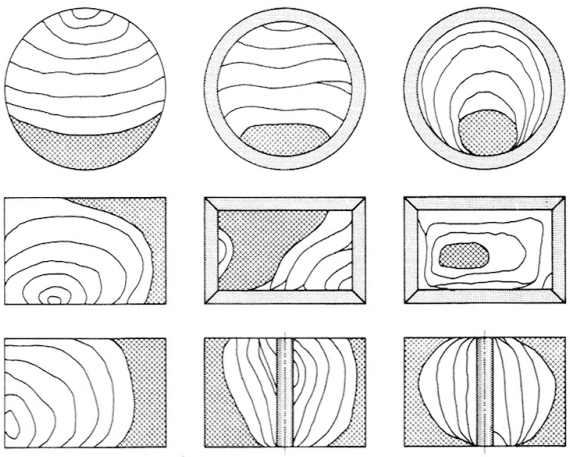

FAILURE ANALYSIS & PREVENTION

engr 3820

homework 5

PROJECT 1 TEAM EVALUATIONS

Complete the CATME online teaming evaluation form for your paperclips or light bulbs team. You'll receive an email with instructions on how to access the online form. **Due Friday, October 7.**

PROJECT 1 SELF-ASSESSMENT

Now that some time has passed, take a moment to reflect on your Project 1 report. As a team, complete a self-assessment of your work using the rubric available on the web site (see link on the Assignments calendar). Please send me your self-assessment by 6 pm on **Friday, October 7.**

CASE STUDY READINGS

The case study readings for the next week or two relate to fatigue failure. Included in this assignment are two articles from *Engineering Failure Analysis,* and a couple articles from medical journals. Links to the medical journal articles will be provided on the Assignments page of the course web site.

- S. Griza et al., Failure analysis of uncemented total hip stem due to microstructure and neck stress riser, *Engineering Failure Analysis* 15 (2008) 981-988.
- J. Chao and V. Lopez, Failure analysis of a Ti6Al4V cementless HIP prosthesis, *Engineering Failure Analysis* 14 (2007) 822-830.
- Y. Kishida et al., Stem Fracture of the Cementless Spongy Metal Lubeck Hip Prosthesis, *Journal of Arthroplasty* 17 (8) (2002) 1021-1027.

As you read and think about this case study, consider these questions:

1. How do the authors support their fatigue failure arguments? What analytical techniques did they use in their investigation? What analyses could they add to better support their arguments?
2. Who's writing these articles (authors' backgrounds)? How do the investigators' backgrounds shape their approach to the failure analysis?
3. How does professional context affect the way in which the authors generate and communicate their results?
4. Consider the redesign of total hip replacements to prevent failure. Come up with three or four key design changes you would introduce to lower the probability of premature failure.

We'll discuss these readings in class on Thursday, Oct. 13.

ASM HANDBOOK READINGS

Yeah, I know. These *ASM Handbook* readings are probably getting a bit old. I'm sorry. It's just that I find a good fatigue failure irresistible, and I want you to share this love with me. As we have discussed in class, fatigue is a common type of failure in load-bearing components, so it is worth taking a look at some formal terminology used in fatigue calculations and discussions.

The following *ASM Handbook* sections should provide some background on fatigue.

Volume 8, Mechanical Testing and Evaluation > Fatigue Testing > Fatigue and Fracture Mechanics >

- Introduction
- Infinite-Life Criterion (S-N Curves) – just read enough to get the general concepts
- Fracture Mechanics Approach – just read enough to grasp the general concepts

Volume 11, Failure Analysis and Prevention > Fracture > Fatigue Fracture Appearances >

- Fatigue Processes
- Microscopic Appearance of Fatigue Fracture in Metals – interested in microstructural features of fatigue fracture surfaces? This reading is for you.
- Fatigue of Polymers and Composites