

- 4 These are used in equation 7.26 (p. 493) along with the value of K from equation c above to find the number of cycles that can be expected at this load before pitting begins.

$$\log_{10} K = \frac{\zeta - \log_{10} N_{life}}{\lambda}$$

$$\log_{10} N_{life} = \zeta - \lambda \log_{10} K = 28.23 - 6.38 \log_{10}(478) \quad (e)$$

$$N_{life} = 10^{(28.23 - 6.38 \log_{10}(478))} = 1.4E11$$

- 5 A safety factor against pitting can now be calculated from the ratio of the projected cycle life and the desired number of cycles.

$$N_f = \frac{N_{life}}{cycles} = \frac{1.4E11}{2.0E10} = 6.9 \quad (f)$$

- 6 This example was solved with both *Mathcad* and *TKSolver*. Its files EX07-05 can be found on the book's CD-ROM.

7.14 SUMMARY

This chapter has presented a brief introduction to the very broad topic of surface wear. Wear is generally considered to be divisible into five general categories: *adhesive wear*, *abrasive wear*, *erosion*, *corrosive wear*, and *surface fatigue*. Other mechanisms such as *corrosion fatigue* and *fretting corrosion* combine elements from more than one category.

Wear usually requires some relative motion to be present between two surfaces. **Adhesive wear** occurs when the asperities of two mating surfaces adhere to one another and then break when sliding occurs, transferring material from one part to the other, or out of the system. **Abrasive wear** involves a hard, rough surface abrading material from a softer one, or loose, hard particles trapped between two surfaces and abrading both.

Corrosion wear occurs when a corrosive atmosphere (such as oxygen) is present to attack the surface of the material in combination with sliding that breaks the oxides or other contaminants free from the surfaces. This exposes new material to the corrosive elements and also turns the often hard corrosion products into abrasants. Corrosion fatigue refers to the combination of a corrosive environment with cyclic stresses. This combination is particularly deadly and greatly shortens the fatigue life of materials. Fretting corrosion occurs in tight joints (such as press fits) where no gross motion is present. Tiny vibratory motions are sufficient to set up a corrosive wear process called fretting that can remove significant volumes of material over time.

Surface fatigue occurs in pure rolling or roll-sliding contact, but not in pure sliding situations. The very high contact stresses engendered by the small areas of contact act to cause fatigue failure of the material after many thousands of cycles of repeated stress. **Pitting** is the loss of small pieces of material from the surface, leaving behind pits. Pits will grow into larger areas of flaked-off surface material, which is then called