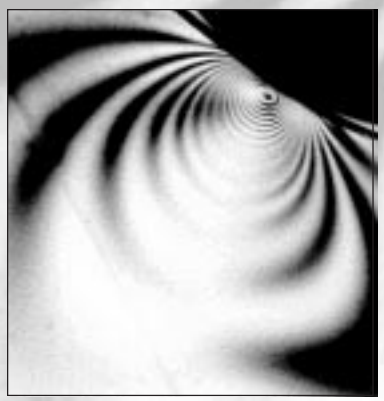
7



SURFACE FAILURE

Use it up, wear it out;
Make it do, or do without.

NEW ENGLAND MAXIM

7.0 INTRODUCTION

There are only three ways in which parts or systems can "fail": *obsolescence*, *breakage*, or *wearing out*. My old Apple II computer still works well but is obsolete and no longer of any use to me. My wife's favorite vase is now in pieces since I dropped it on the floor, and it is irrecoverable. However, my 120 000-mile automobile is still quite serviceable and useful despite showing some signs of wear. Most systems are subject to all three types of possible failure. Failure by obsolescence is somewhat arbitrary. (My niece is now getting good use of the Apple II.) Failure by breakage is often sudden and may be permanent. Failure by "wearing out" is generally a gradual process and is sometimes repairable. Ultimately, any system that does not fall victim to one of the other two modes of failure will inevitably wear out if kept in service long enough. Wear is the final mode of failure, which nothing escapes. Thus, we should realize that we cannot design to avoid all types of wear completely, only to postpone them.

The previous chapters have dealt with failure of parts by distortion (yielding) and breakage (fracture). **Wear** is a broad term that encompasses many types of failures, all of which involve changes to the **surface** of the part. Some of these so-called *wear mechanisms* are still not completely understood, and rival theories exist in some cases. Most experts describe five general categories of wear: **adhesive wear**, **abrasive wear**, **erosion, corrosion wear**, and **surface fatigue**. The following sections discuss these topics in detail. In addition, there are other types of surface failure that do not fit neatly into one of the five categories or that can fit into more than one. **Corrosion fatigue** has aspects of the last two categories as does **fretting corrosion**. For simplicity, we will discuss these hybrids in concert with one of the five main categories listed above.