REPAIR POLICIES AND STOCHASTIC ORDER

BY THOMAS H. SAVITS*

University of Pittsburgh

This paper reviews the role of stochastic order as it relates to the study of maintained systems in reliability theory. The classical univariate comparison results for the age and block replacement policies are presented. Extensions to stochastic comparison of processes and recent generalizations of age and block policies are also discussed.

1. Introduction. The purpose of this paper is to survey the role of stochastic order as it relates to the study of maintained systems in reliability theory. Some of the earliest treatments of maintenance considerations date back to Khintchine (1932), Lotka (1939), Campbell (1941), and others. An excellent presentation of the historical background is contained in the book of Barlow and Proschan (1965).

Maintenance policies are followed so as to reduce the number of system failures. Typically, as a unit ages it tends to break down more frequently. Since these *unplanned* failures can be costly, it may at some point in time be more cost effective to simply replace the unit before it fails with a new unit. Any such strategy of *planned* replacement is called a maintenance policy. Two policies that have received considerable attention in the literature are known as age and block replacement policies. These will be reviewed in Section 2.

The (cost) effectiveness of a maintenance policy has been quantified in various ways. One simple measure is in terms of the expected number of failures (and/or repairs). This information would be sufficient provided the replacement costs are identical and constant. For more complex cost structures, however a better measure is provided through the notion of stochastic order. Early comparisons were between random variables; the modern viewpoint is to compare processes.