

# Optimal Random Maintenance Policies

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**Abstract** This paper summarizes the random maintenance policies and random inspection policies for an operating unit which works at successive random times. Two replacement models are considered: (1) the unit is replaced before failure at a planned time  $T$  or at a number  $N$  of working times, whichever occurs first, (2) the unit undergoes minimal repair at failures and is replaced at a planned time  $T$  or at a number  $N$  of working times, whichever occurs first. The expected cost rates for each model are obtained, and optimal policies which minimize them are derived analytically.

It might be useless to replace an operating unit even when a planned time  $T$  comes and be wise to replace it at the first completion of the working time over time  $T$ . We sometimes want to use the unit as long as possible. From such viewpoints, we propose two modified replacement models where the unit is replaced at the first completion of the working time over time  $T$ , and it is replaced at time  $T$  or number  $N$ , whichever occurs last, are discussed. We obtain explicitly the expected cost rates of the two modified models.

Similar to the replacement models, two inspection models are considered: (3) the system is checked at periodic times and at every completion of working times, (4) the system is checked at successive times and at every completion of working times. The total expected costs until the detection of failure are obtained. Furthermore, the inspection policy where the system is checked only at every completion of  $N$ th working times is also proposed. Finally, the backup model where the system goes back to the latest checking time when it has failed is taken up and is analyzed, by using the inspection policy.