

Reliability evaluation of engineering systems

Problems

- 1 A system consists of five identical components, all of which must operate for system success. If the failure rate and average repair time of each component is 0.01 f/yr and 48 hr respectively, calculate the system failure rate, average down time and unavailability.
- 2 The system described in Problem 1 is reinforced by connecting a second identical system in parallel with the first. Evaluate the new system failure rate, average down time and unavailability.
- 3 If each of the series chains in Problem 2 is maintained once a year for an average time of 8 hr, evaluate the new system reliability indices.
- 4 Derive an expression for the contribution of component failures overlapping a maintenance outage for a parallel system consisting of three components. Assume that maintenance of a component will not be started if another component is already failed or is already out on maintenance.
- 5 Evaluate the three system reliability indices for the bridge network shown in Figure 5.1 if all components are identical having $\lambda = 0.1$ f/yr, $\lambda'' = 1$ outage/yr, $r = 48$ hr and $r'' = 8$ hr. In the case of the maintenance contribution assume the same constraints as in Section 11.6 and Problem 4.
- 6 A system consists of two components 1 and 2 of which at least one must operate for system success. Evaluate the system failure rate, average repair time and unavailability if the common-mode state space diagram shown in Figure 11.4a is applicable and $\lambda_1 = 0.01$ f/yr, $\lambda_2 = 0.02$ f/yr, $\lambda_{12} = 0.001$ f/yr, $\mu_1 = 0.5$ r/yr, $\mu_2 = 1.0$ r/yr and $\mu_{12} = 0.01$ r/yr. Compare your results with those of Problem 7 in Chapter 10.