SHOULD MINIMAL REPAIR DEPEND ON INFORMATION?

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The notion of minimal repair with respect to a history is defined in terms of a general filtration and a completely unpredictable stopping time. An inequality relating compensator transformations with respect to the minimal history of a one-point process and a richer history is proven. Applied to minimal repair, this result shows that the modeling of minimal repair in a "black box" sense always gives a stochastically longer life length than a more realistic model.

1. Introduction. The notion of minimal repair was introduced in reliability theory by Barlow and Hunter (1960). Its intuitive meaning is putting the system back to operation when it fails in such a way that the situation immediately preceding the failure is restored. The traditional probabilistic model is the following. Consider a nonnegative random variable S (the life length of the system) with a continuous distribution function F. When the system fails, say at time $S = s$, it is given an additional lifetime S' with conditional distribution

$$P(S' > t \mid S = s) = P(S > s + t \mid S > s) = (1 - F(s + t))/(1 - F(s)).$$

Equivalently, the minimal repair model can be defined in terms of the cumulative hazard function

$$R(t) = -\ln(1 - F(t)) = \int_0^t \frac{dF(s)}{1 - F(s)}$$

as follows. · The original failure point $S(\omega)$ is "erased" and the hazard of the additional life time S' at age $t - S(\omega)$ is given the same value as the original hazard would have had at time t had there been no failure, that is, $dR(t)$. If minimal repairs are made repeatedly, the sequence of repair times is a nonhomogeneous Poisson process with integrated intensity $R(t)$.

This simple notion of minimal repair has obvious intuitive appeal. However, it may not be a realistic description of any actual repair done on a failed system.

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