Updated Hazard Rate Equation

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**ABSTRACT**

The following equation is commonly used to evaluate the hazard rate ($HR$) given the failure rate ($\lambda$), the demand rate ($D$) and the testing interval ($T$):

$$HR = \lambda \cdot (1 - e^{-DT/2})$$

This equation has enjoyed widespread acceptance as a simple yet rigorous solution for the hazard rate. Despite its reputation, this equation tacitly includes simplifications which result in over-calculation of the hazard rate at some combinations of failure rate, demand rate and testing interval. While this difference is often small, the calculated rate can be substantially greater than the actual rate.

A method has been developed to accurately determine the hazard rate at all combinations of failure rate, demand rate and testing interval. This required evaluating the likelihood of encountering a failed safeguard, given a demand. A Monte Carlo approach was used to simulate the random demands. This method did not lend itself to an analytical solution; however, the following empirical equation was developed:

$$HR = \left(\frac{100}{100 + X}\right) \cdot \lambda \cdot (1 - e^{-DT/2})$$

Where:

- $X = (44 - 11.33DT) \cdot \lambda T$ for $DT \leq 1$,
- $X = 20 - DT + (27 - 1.76 \cdot DT) \cdot \lambda T$ for $DT > 1$.

This equation applies a correction factor to the existing hazard rate formula. With this adjustment, the hazard rate can be easily and accurately determined for all combinations of failure rate, demand rate and testing interval.