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ON COMPETING RISKS AND DEGRADATION PROCESSES

Nozer D. Singpurwalla

The George Washington University, USA, *nozer@gwu.edu*

In this paper, I first introduce the notion of a Hazard Potential (HP) as the unknown amount of a resource possessed by an item at its inception. I argue that the HP has an exponential distribution with scale parameter one. The notion of an unknown resource possessed by an item is not new; it can be attributed to Sedyakin. However, its characterization is new in the sense of its distribution and the feature that an item fails when its cumulative hazard hits its HP. This feature enables us to look at interdependent lifetimes in a new light and furthermore, it enables us to produce new families of joint distributions with interdependence.

The focus of this paper however is to articulate on the notion of competing risks, and competing risk processes via the HP. To do so, one needs to model the cumulative hazard rate as a stochastic process and in the case of dependent competing risks a multivariate stochastic process.

The second focus of this paper is on degradation modeling via markers. The idea here is that a marker such as a crack length or a CD4 cell count is a marker that is caused by the cumulative hazard function which is indeed responsible for failure. Thus a marker provides information about the failure causing process. This viewpoint is contrary to conventional practice wherein the marker is seen as the cause of failure. The marker can be modeled by any stochastic process, such as the Wiener process, but the cumulative hazard must be a non-decreasing process, such as the Levy process. The two processes need to be linked in order that the marker can provide information about the failure causing process.

The above strategies are discussed in the paper together with some directions via which one can conduct a Bayesian analysis of the Wiener process with drift.