Statistical Inference of a Parametric Recurrent Event Model Under Competing Risks

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The focus of this talk is on failure history of repairable systems for which the relevant data comprise successive event times for a recurrent phenomenon along with an event-count indicator. Such data commonly occur both in industrial and biomedical contexts. In an industrial setting, typically a single expensive prototype of a complex system is observed until failure, followed by corrections or design changes, and subsequent retesting. In the biomedical context, however, it is more common to encounter data on multiple subjects with only a few recurrences per subject. In this talk we shall describe the findings from a study of failure data representing a single and multiple cluster of recurrent events subject to multiple failure modes, a framework traditionally dubbed as competing risks. We adopt a parametric premise and discuss the results under the Power Law Process model that has found considerable attention in describing recurrent hardware failures of complex mechanical systems. Some interesting and non-standard asymptotic results ensue in this context that will be discussed in detail. We will report findings from an extensive simulation study that supplements the theoretical findings. A special focus will be on the case where the cause of failure may not be fully identified (masked). The methodology will be illustrated on recurrent failure data obtained from a warranty claim database for a fleet of automobiles.

Keywords: power law process; repairable systems; missing cause of failure.