Preservation of non-parametric distribution class under a system signature representation

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Classes of non-parametric distributions, such as increasing failure rate distributions, new is better than used distributions and others, have been extensively investigated in reliability theory. They can be used to achieve the benefit of a maintenance operation or to derive bounds on system reliability. Several extension of these concepts appeared in the literature, in particular, if we observe the system's components continuously on time, through a filtration, to introduce the notion of increasing failure rate distributions and new better than used distribution relative to the observed filtration, generalizing the conventional definition and extending theseclasses into a multivariate version. In this work, we intend to analyse the preservations of these non-parametric distributions classes, relative to the filtration, for a coherent system under a point process signature representation of system reliability. System signature is defined under the assumption of independence, identically and continuously distributed component's lifetimes and the point process signature process is defined when simultaneous failures are ruled out. The coherent system reliability representation through the system signature is substantially useful and its representation under a point process signature is suitable to analyse coherent system of dependent components. In this context, to generalize classical results using the properties of non-parametric distributions classes relative to a filtration, we need to verify if these properties are preserved under the formation of coherent systems.In particular we prove that: If the components lifetimes of a coherent system are multivariate increasing failure rate (new is better than used) distribution relative to the filtration, then the system lifetime is increasing failure rate(new is better than used) distribution relative to the filtration .

Keywords: increasing failure rate relative to a filtration; new is better than used relative to a filtration.