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Inference in a model of successive failures with shape-adjusted hazard rates

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Abstract For successive failure times of components in a technical system, a flexible model based on sequential order statistics is proposed. Beyond the common assumption of proportionality, this model allows for structural adjustments of the hazard rates of the underlying lifetime distributions in situations, where failures have an impact on the entire shape of the hazard rate of remaining components. The hazard rates may be chosen, e.g., as strictly ordered bathtub curves. The general structure is analysed, and maximum likelihood estimators are stated for both, unrestricted and order restricted model parameters, as well as for parameters connected by a linear link function. Several properties of the estimators are obtained. Utilizing the maximum likelihood estimators, simultaneous confidence regions based on the Jeffreys–Kullback–Leibler distance and the Hellinger distance are examined.

Keywords Sequential order statistic · Load sharing system · Proportional hazard rate · Bathtub shape · Maximum likelihood estimation · Order restricted inference · Link function · Confidence region · Distance measure

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