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Robust Bayesian Reliability Demonstration Testing

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To demonstrate reliability at consecutive timepoints, a sample at each current timepoint must prove that at least $100p\%$ of the devices of a population function until the next timepoint with probability of at least $1 - \omega$.

For testing that reliability, we develop a failure time model which is motivated by a Bayesian rolling window approach on the mean time to failure. Based on this model and a Bayesian approach, sampling plans to demonstrate reliability are derived.

We will apply these sampling plans on data generated by power law processes, that have a time dependent mean time to failure, to demonstrate the balance between the flexibility of the developed model and the slightly increased costs due to not assuming a constant mean time to failure. Good frequentist properties and the robustness of the sampling plans are shown.

We apply these sampling plans to test if the verification validity period can be extended for e.g., a population of utility meters which are subject to section 35, paragraph 1, No. 1 of the Measures and Verification Ordinance in Germany [1]. Accordingly, the verification validity period may be extended if it can be assumed that at least 95% of the measuring instruments conform with specified requirements during the whole period of extension.

[1] Mess- und Eichverordnung (MessEV), December 11th, 2014 (Bundesgesetzblatt I, p. 2010 - 73), last amended by Article 1 of the Ordinance of October 26, 2021 (Bundesgesetzblatt I, p. 4742).
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Classification

Both methodology and application

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