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A Novel Approach to Reliability Data Selection and Integration for IFMIF-DONES Accelerators

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The motivation of this work is the development of new methods for selection and combination of multi-source reliability data to obtain useful results within the WPENS project for the IFMIF-DONES facility.

Typically, the component failure rates used in RAMI studies are estimated by the heterogeneous datasets extracted from several sources of different content, structure, and accuracy. This poses an important problem: databases might not be complete in the sense of that the information is limited (e.g. only mean values are available), or simply, is missing. With the objective of integrating multiple inputs into one model of the failure rate, a novel methodology consisting of two phases is introduced. Firstly, a Bayesian result is adopted to prove that the failure rate can be modelled through a Gamma distribution, and secondly, two common approaches of the reliability analysis are proposed (method of moments and minimizing the Kullback–Leibler divergence) to fuse Gamma distributions coming from different components used in the accelerator.

The performance of this methodology is validated by means of a depth simulation study by introducing different sample sizes and data affected by homogeneity and heterogeneity. Finally, it is applied to an empirical dataset.

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