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Recent Results for Monotonous Reliability Systems with Simultaneous Failures

Binary reliability systems have been studied for around a century. They are formed by a number of components, where each can be working or failed, and the system is also either working or failed depending on the state of its components. Despite their simplicity, their study poses important combinatorial challenges, most prominently an exponential explosion of states, as there are 2^n possible states of the system, where n is the number of components. Because of this, their analysis focuses mostly on simplified settings, and most results consider iid non-simultaneous failure times of components, or so-called k-out-of-n systems, that fail when k of its components have failed. In this talk, I will give a summary of recent results when using the Levy-frailty Marshall-Olkin distribution to model the components' lifetimes. This is a versatile Markovian model that allows simultaneous failures of the components, is easy to simulate, and requires very few parameters; however, it has received little attention in the literature. Our recent results include explicit formulas for the cost-rate of repairs under simple repair policies [arXiv:2601.08786], and also approximations of the failure times of very large systems [arXiv:2501.04659].

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Guido Lagos is an Assistant Professor at the Faculty of Engineering of Sciences of Universidad Adolfo Ibanez (UAI) in Chile, at the Vina del Mar campus. His main research area is Applied Probability for Reliability Modeling. Guido Lagos holds a PhD in Operations Research from Georgia Tech, Atlanta, GA, USA, where the advisor was prof. Ton Dieker and they worked in Applied Probability — broadly speaking the work was about mathematical guarantees for efficiency and accuracy of algorithms that simulate stochastic processes and specific events of them. Guido Lagos served as a Chair of the leading reliability conference – International Conference on Mathematical Methods in Reliability held in 2024 in Chile.

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