Contribution ID: **10** Type: **not specified**

On the modelling of dependence between univariate Lévy wear processes and impact on the reliability function

Thursday, 19 May 2022 10:30 (20 minutes)

Univariate Lévy processes have become quite common in the reliability literature for modelling accumulative deterioration. In case of correlated deterioration indicators, several possibilities have been suggested for modelling their dependence. The point of this study is the analysis and comparison of three different dependence models considered in the most recent literature: 1. Use of a regular copula, where the dependence in a multivariate increment is modelled through a time-independent regular copula; 2. Superposition of independent univariate Lévy processes, where each marginal process is constructed as the sum of independent univariate Lévy processes $\{X_j(t), t \geq 0\}$ with possibly common $\{X_j(t), t \geq 0\}$ between margins; 3. Use of a Lévy copula. The three methods are first presented and analysed. As for the model based on a regular copula, it is shown that the corresponding multivariate process cannot have independent increments in general, so that it is not a Lévy process. This means that the distribution of the multivariate process is not fully characterized in this way. The second and third models both lead to a multivariate Lévy process, with a limited dependence range for the second superposition-based model, which is not the case for the third Lévy copula-based model. However, this last model requires a higher technicity for its use and numerical methods (such as Monte-Carlo simulations) have to be used for its numerical assessment. Practical details are given in the paper and two Monte-Carlo simulation procedures are compared.

A two-component series system is next considered, with joint deterioration level modelled by one of the three previous models. Each component is considered as failed as soon as its deterioration level is beyond a given failure threshold. The impact of a wrong choice for the model is explored, based on data simulated from one of the three models and next adjusted to all three models. It is shown that a wrong choice for the model can lead to either surestimate or underestimate the reliability function of the two-component series system, which could be problematic in an applicative context.

Primary authors: MERCIER, Sophie (University of Pau and Pays de l'Adour); VERDIER, Ghislain (University of Pau and Pays de l'Adour)

Presenter: MERCIER, Sophie (University of Pau and Pays de l'Adour)

Session Classification: Degradation models