ID de Contribution: **137** Type: **Contributed talk**

Convexity of elliptically distributed chance constraints with copula structures dependent on decision variables

mardi 29 juillet 2025 11:45 (30 minutes)

Chance constraints describe a set of given random inequalities depending on the decision vector satisfied with a large enough probability. They are widely used in decision making under uncertain data in many engineering problems. This talk aims to derive the convexity of chance constraints with elliptically distributed dependent rows via a Gumbel-Hougaard copula. The eventual convexity of chance constraints is separated as the concavity and convexity of two auxiliary functions: the first one is a probability function, and a copula's generator defines the second one. For the probability function, comparing to the r-concavity results with $r = -2$ in [1] and $r < -1$ in [2], we obtain the thresholds of the r-concavity for any real number r. Then, we improve probability thresholds of the eventual convexity, which are all less than the thresholds in [1, 2, 3]. With respect to the function defined by a copula's generator, we extend the assumptions about the copula and the domain Ω without the origin in [3] and estimate the singularity of Gumbel-Hougaard copulas around the origin, where the singularity can lead to the copula's unboundedness. Finally, we prove the eventual convexity with elliptical distributions and a Gumbel-Hougaard copula despite the copula's singularity near the origin. To illustrate our results, we provide an example with the eventual convexity of a feasible set containing the origin.

References
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Classification de Session: Chance-constrained programming

Classification de thématique: Chance-constrained programming