

## Master's Project Chance Constraints on Non-symmetric Probability Density Functions

Chance constraints are a clever way to incorporate known uncertainty into optimization problems. These constraints enforce a desired level of probability on an inequality constraint. Our department has an existing Python framework, which is already able to calculate the probability and its first and second derivatives for single chance constraints on multi-variate normal distributions. This is shown in the figure below.  $h$  is the inequality constraint, which is supposed to be held with a desired probability level. The green surface shows a bivariate normal distribution.

In real-life applications, experimental data combined with models seldom shows multivariate Gaussian behavior. Non-symmetric distributions as the "Dirichlet distribution" or a "Weibull distribution" can also be observed.

Within the scope of this Master's thesis, the existing chance-constraint framework (DoCCE) is supposed to be extended by two major new functionalities:

- (1) the introduction of sparse grids and integration techniques for non-symmetric distributions and
- (2) joint chance constraints, which compute probabilities for two or more inequalities at the same time.

The existing framework is implemented in Python 2.

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