**Extreme dependence models and Environmental contours for safety assessment**

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**Abstract :**

In coastal area, both human activities and structures are subject to the impact of extreme events, with possible dramatic consequences. However, high losses may not be caused by a single environmental parameter being extremely high, but by the conjunction of high levels on several variables: for instance, severe tensions on mooring lines of a floating structure may be caused by a conjunction of high wind, high currents and large waves, but not only with one variable being extreme. In addition, the directions of such events must be taken into account. In such a multivariate context, the environmental contour concept is an effective, risk-based approach in establishing design conditions.

In this work, we will compare two methods for modeling of extremes in three dimensions, via the classical extreme copula approaches and conditional models, that have be recently proposed by Heffernan & Tawn [1]. Along with the modeling of extreme values, we will compare two methods for deriving environmental contours: the classical Rosenblatt transformation from the environmental parameter space to a standard normal space, and the newly proposed Huseby method [2] which establishes environmental contours based on direct Monte Carlo sampling from the joint distribution. The results will be compared to the extreme tensions obtained from a meta-model of a semi-submersible platform.

**References :**

[1] Heffernan, J.E., Tawn, J.A., 2004, "A conditional approach for multivariate extreme values (with discussion)", *Journal of the Royal Statistical Society: Series B*, vol. 66, no. 3, pp. 497-546.

[2] Huseby, A.B., Vanem, E., Natvig, B., 2015, "Alternative environmental contours for structural reliability analysis", *Structural Safety*, vol. 54, pp. 32–45.