

## Post-doctoral position: Metamodelling with Categorical Variables

### Chair in Applied Mathematics OQUAIDO

#### Context and methodology

This post-doctoral position is associated to the Chair in Applied Mathematics OQUAIDO of Mines Saint-Étienne, starting in January 2016. The Chair, which follows the ReDICE consortium ([www.redice-project.org](http://www.redice-project.org)), aims at gathering industrial and academic partners around innovative mathematical methods for the design and analysis of computer experiments. Among the research lines with strong methodological interest and promising application potential that have been identified by the Chair scientific committee, this post-doctoral position will focus on models including categorical input variables.

The objective of the post-doctoral research is to develop generic methods aiming at building statistical models with mixed categorical and continuous inputs and at developing optimization and/or inversion methods based on such models. One method that will be investigated is Gaussian process metamodels with original covariance kernels but other frameworks may be considered as well. The expected results are methodological with publications in journals and international conferences.

A motivating application for this research is provided by the French Alternative Energies and Atomic Energy Commission (CEA) which is one of the industrial partners of the Chair. This application is based on the open access computer code MNCP which performs Monte Carlo simulation for computing the gamma spectrum of an object given the radionuclide masses and some categorical input variables (such as geometrical form or material type). The challenge here is to solve an inverse problem (recovering the radionuclide masses and types given the measured gamma spectrum).

#### Applicant profile

Candidates should have recently completed a PhD in applied mathematics, statistics, machine learning, or related disciplines. The applicant should demonstrate both theoretical and computational skills, and feel comfortable with scientific writing. Implementations in R are expected.

CV and motivation letter in English or French should be sent to the coordinators of the Chair (Olivier Roustant and Nicolas Durrande) using the e-mail address: [oquaido@emse.fr](mailto:oquaido@emse.fr).

#### Conditions

- Date/duration: The position is a 12 months contract, open from January 2016 until filled.
- Location: Mines Saint-Étienne, France.
- Net salary: 2.350 €/month

#### References

- [1] Clement Chevalier, Julien Bect, David Ginsbourger, Emmanuel Vazquez, Victor Picheny, and Yann Richet. Fast parallel kriging-based stepwise uncertainty reduction with application to the identification of an excursion set. *Technometrics*, 56(4):455–465, 2014.
- [2] Laura P. Swiler, Patricia D. Hough, Peter Qian, Xu Xu, Curtis Storlie, and Herbert Lee. Surrogate models for mixed discrete-continuous variables. In Martine Ceberio and Vladik Kreinovich, editors, *Constraint Programming and Decision Making*, volume 539 of *Studies in Computational Intelligence*, pages 181–202. Springer International Publishing, 2014.
- [3] Yulei Zhang and William I. Notz. Computer experiments with qualitative and quantitative variables: A review and reexamination. *Quality Engineering*, 27(1):2–13, 2015.