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## Postdoctoral Position

### Institut Français du Pétrole (IFP), Solaize, France

#### **Subject : Response Surfaces under constraints**

Because physical models are not predictive enough in motor calibration design, to represent engine exhausts, one has to resort to response surfaces techniques. Experimental data are fitted by means of non linear regression, locally when the torque and the engine speed are both fixed, or globally when everything vary.

To check the results, engineers rely on their expertise. For example, locally, CO<sub>2</sub> emissions should decrease when the main injection timing (AVI) and the fuel injection pressure (PRAIL) increase. Globally, constraints coming from physical limitations and considerations become more and more stringent.

However, traditional regression techniques do not guarantee that all the constraints will be satisfied. In the case of CO<sub>2</sub>, one should observe monotony constraints, i.e. the response should increase or decrease monotonically when AVI and PRAIL vary. Similarly, maximum or minimum values are not guaranteed to be respected, since the calculated response can oscillate between the fitting points.

From the end of 90's, some new methods have been proposed to alleviate these limitations. A bibliographical review shows that many different techniques have been proposed, based on available regression techniques. Smoothing splines have been used, as well as generalized additive models, krigging or wavelets. Some of these developments are available through internet.

The goal of this post-doctoral study is to propose strategies to tackle these problems, to test and use the new techniques that have to be developed, and to apply them to the case of responses surfaces in the field of motor calibration. Coding will be done in MATLAB. Expected difficulties concern the high dimension of the regressors space, as well as the calculation time which has to stay manageable.

#### **Education and qualification:**

**PhD in applied mathematics or in statistics**, solid background in experimental design and response surfaces methodology. Practice of a programming language like MATLAB, C or FORTRAN.

**location :** Institut Français du Pétrole (IFP, <http://www.ifp.fr>) at Solaize, near Lyon

**Beginning:** June 2008

**Duration:** 12 to 18 month

**Salary :** ~2862€/month (+ 474€/month for lodging expenses for foreigners coming from foreign universities only)

Interested candidates should send a CV, a motivation letter, a publication list and referee letters to:

**Dr. François WAHL, IFP**  
**François.Wahl@ifp.fr**

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