

## **OPEN PhD POSITION at IFP's Engine CFD & System Simulation Department, Rueil-Malmaison, France**

### **About IFP**

IFP is a world-class public-sector research and training center, aimed at developing the technologies and materials of the future in the fields of energy, transport and the environment. It provides public players and industry with innovative solutions for a smooth transition to the energies and materials of tomorrow – more efficient, more economical, cleaner and sustainable.

In a constant drive for progress, IFP aids the conversion from invention to innovation, from patent to product and from research to industry. Since its inception, IFP has therefore been a major driving force for industrial development, with more than 40,000 patents to its credit filed in France and throughout the world (including more than 12,800 active patents).

From the outset, IFP has been committed to seeing the outcome of its research exploited by industry. This has prompted it to support the creation of some thirty companies, which have themselves become significant employers and exporters. A core component of the policy of technology transfer to the market, these businesses span all the research fields in which IFP is active: from oil research, consultancy and engineering to the supply of products, equipment and services, together with new energy technologies (NET).

### **About VECOM**

Vehicle Concept Modeling refers to the emerging field of up-front pre-CAD functional performance engineering in the vehicle development process. The research area is of highly strategic importance to European automotive OEMs, who must launch products on an ever shorter time frame, at increased quality of multiple performance attributes. When simulation results become available in an early design stage, problems can already be solved before the first detailed CAD model is created, which will increase the quality of the first detailed simulation models and reduce the time to market. Moreover, early what-if studies can be performed to balance and optimize possibly conflicting performance attributes (safety, NVH, dynamics, durability ...) at an increased feasibility and at reduced costs. Novel methods will be developed to address this industrial need for a novel engineering process in which analysis leads the design. Applications will be worked out across partners and application fields, fully embedded in the vehicle industry context. Apart from benefits to researchers, partners and industrial stakeholders (additional OEM and other industry), the project will strengthen the competitive position of the European vehicle industry in the increasingly global market.

**Consortium:** A well-balanced group of 6 universities, 4 research institutes and 4 companies, active in concept CAE simulation and functional performance engineering of vehicles and its constituent subsystems. The industrial partners bring in application knowledge and expertise, and the academic partners bring in a range of CAE methodologies, the capability of research training, provision of courses and dissemination of results.

## Position 1: Early Stage Researcher (ESR)

### Position Profile

- Place:** Engine CFD & System Simulation Department  
IFP [www.ifp.fr](http://www.ifp.fr)
- City:** Rueil-Malmaison
- Country:** France
- Tasks:** Based on a Career Development Plan the candidate will receive a full doctoral training and will be required to develop own research work leading to PhD degree on the topic of "Detailed analysis of an urea SCR catalyst under low temperature operating conditions in order to develop a macro-kinetic model for engine system simulation".
- In order to meet future regulations on pollutant emissions, manufacturers have to develop more and more complex after-treatment systems. The urea Selective Catalyst Reduction seems to be one of the most promising ways to reduce nitrogen oxides. However, setting up such a solution is very complex as it needs, for instance, a perfect control of urea injection. To develop this complex system engineers need relevant numerical tools (engine simulators) to minimize development cost. In the present context, we want to develop a OD macro-kinetic model of this catalytic process taking into account numerical constraints imposed by its use in a full engine simulator and being able to predict NH<sub>3</sub> management and nitrogen oxides conversion in a large temperature operating range (100°C-700°C) and in a large composition range NO<sub>2</sub>/NO<sub>x</sub>.
- The main issue concerns the understanding of low temperature operating conditions (100°C-250°C) notably due to ammonium nitrate formation inside the catalyst. Thus, the main objective is to identify and to develop a simple chemical scheme which will be implemented in a zero dimensional model. To achieve it, detailed kinetic schemes and experimental analysis will be used to find the key mechanisms at play. Concerning the interest of the subject, one main issue is to develop a methodology to extract from detailed scientific analysis some relevant information in order to develop an industrial simulation tool.
- Short stays at other network partners' sites could be required to complete the training program.

## Candidate Requirements

**Studies:** The candidate must hold an Engineering degree (MSc or equivalent allowing access to PhD training), preferably in the domains of process engineering and/or applied catalysis, with a solid background on piston engine after-treatment.

**Experience:** Less than 4 years post-degree research experience

**Nationality:** According the EC mobility criteria, other than French, preferably European, and not have lived for more than 12 months in France previous to the appointment.

**Languages:** Fluent English, notions of French appreciated

**Computer skills:** Knowledge on : applied catalysis, chemical kinetics, mastering of C coding with ideally a first experience in numerical simulation. Interest for the domain of piston engines is a must.

### **Employment Condition**

***Employment contract:*** Grant agreement, including the social security coverage applied to employees in France.

***Commitment length:*** 3 years

***Salary:*** According to the applicable reference rates specified on the FP 7 Marie Curie Grant Agreement.

***Start date:*** ASAP

***Equal opportunities*** Female candidates are highly encouraged to apply. Facilities for children care (kindergarten) are available at the University

### **Application Procedure**

Send a **detailed CV** together a **letter of motivation** and **names of reference(s)** to:

Dr. André NICOLLE  
IFP-R102  
1 & 4, avenue de Bois-Préau  
92852 Rueil-Malamison Cedex  
France  
E-mail: [andre.nicolle@ifp.fr](mailto:andre.nicolle@ifp.fr)