

## OFFERING 3 PHD SCHOLARSHIPS IN THE SUSCAPE GROUP

### Project #1: Optimal design and planning of sustainable chemical processes via hybrid simulation-optimization approaches

#### Research project #1:

The goal of this research project is to develop systematic tools for the **optimal design and planning of sustainable chemical processes** based on a hybrid simulation-optimization approach. The project will focus on the combined use of **rigorous optimization techniques** (GAMS, AMPL, etc.), process simulators (HYSYS, ASPEN, etc.) and **life cycle assessment (LCA) principles** as a manner to automate the search for alternatives that lead to environmental and economic improvements in a chemical process. The final aim is to devise a general modeling and solution framework for systematically generating the set of all feasible solutions to a process design problem, from which the best ones will be identified via systematic optimization tools. This methodology will be validated through real case studies taken from **ongoing collaborations with leading chemical companies and academic institutions**.

### Project #2: Development of global optimization methods for the efficient solution of process engineering and biological problems

#### Research project #2:

This research project will focus on developing novel **global optimization techniques** for the solution of mixed-integer nonlinear programming optimization problems (MINLP), with special emphasis on **process engineering** (synthesis of heat exchanger networks, optimization of biotechnological batch processes, etc.) and **bioengineering applications** (optimization of regulated metabolic systems, evolution studies, etc.). From the algorithmic point of view, the objective is to investigate efficient solution methods based on spatial branch and bound and outer approximation schemes. These strategies will be applied to problems in the areas of **systems biology** and **process systems engineering** that have attracted increasing attention in the last years.

### Project #3: Energy supply options with conventional and renewable energy systems

#### Research project #3:

This project will focus on the analysis and optimization of supply chains **for energy production**. Different generation technologies and conventional and renewable energy sources will be considered.

Most energy optimization models consider production cost (**economics**) and some environmental indicator (**ecology**), as for example greenhouse gas emissions. Results give only some partial view of the problem. Life cycle assessment (LCA) considers the impact of the whole **energy supply chain**, which consists of raw materials suppliers, production and storage facilities and final markets. Conventional electricity generation technologies include, among many others, nuclear energy, combined cycles, fuel cells, gas turbines and steam cycles that are operating with different fuels. Also the option of carbon sequestration has to be evaluated. Among renewable energy sources, the most promising ones are solar, wind, geothermal, biomass and hydroelectric. Our research goal is to develop quantitative tools based on **mathematical programming** to address the design and planning of sustainable energy production processes. Our approach will rely on the combined use of **multi-criteria mixed-integer modeling techniques and LCA principles** as a way of systematizing the computation of process alternatives that may lead to important **environmental savings in energy applications**.

**Deadlines and timing:**

Deadline for the paperwork: March-April 2010 (exceptional candidates will be considered in January 2010).

Start date: September 2010 (negotiable)

**Salary:**

The PhD studies are funded with a scholarship during the first two years and a labor contract for the remaining period (1 or 2 years).

Net salary is around 1050 euros/month during the first two years and includes medical insurance.

**Application and candidates:**

Candidates should have a bachelor and/or a master degree in **Chemical Engineering, Industrial Engineering, Computer Science, Physics or Mathematics**. Additional background, knowledge or experience in **process modeling** as well as basic knowledge of standard modeling **software packages** (e.g. Aspen Plus, Matlab, HYSYS, GAMS...) will be considered as a valuable asset. The bachelor degree or Masters degree must have been obtained before August 31st, 2010 to be eligible. Interested candidates should send an electronic version (pdf) of their CV and an academic expedient (subjects, credits and grades) to [laureano.jimenez@urv.cat](mailto:laureano.jimenez@urv.cat). Optionally, the interested candidates can also send a research expression of interest letter and up to 3 (scanned) recommendation letters with the mentor's contact details. In the topic of the e-mail please use the words "SUSCAPE-PhD scholarships". Skype accounts will be highly appreciated because they offer the possibility to have a personal on-line interview.

**About the research group:**

The **SUSCAPE group is an internationally recognized leader** in process systems engineering that focuses on process simulation and advanced mathematical programming techniques applied to multi-criteria problems ([www.etseq.urv.es/suscape](http://www.etseq.urv.es/suscape)). Our group is characterized by an inspiring environment dedicated to research on sustainable process design. The PhD program supports short stays in leading **international research groups in USA (Carnegie Mellon University) and Europe (Imperial College London)**. The position is **fully funded** with an attractive remuneration package.

**About the University and the PhD program:**

Additional information about the University Rovira i Virgili can be found at:

[http://www.urv.cat/en\\_index.html](http://www.urv.cat/en_index.html)

For more information about the PhD program, please check:

<http://www.etseq.urv.es/doctorat/web/>

**About Tarragona:**

Tarragona is a medium city (around 100,000 inhabitants) with a **Mediterranean climate** and many recreation opportunities (nice beaches, theme parks, touristic resorts and facilities). It is located **100 km Southwest of Barcelona** and it is well communicated by train (1 hour train ride with trains every 30 minutes), with highways and low cost flights to Europe from its own airport.

**Timing:**

Paperwork: March-April 2010

Start date: September 2010 (negotiable)