*Project name:* **Stochastic optimization of heat exchanger networks in the chemical industry**

*Vacancy:* ***YES***

*Summary:*

The management of energy in a chemical process is critical to ensure its operational and economic feasibility, also having a very significant impact on its environmental performance. Because of this, heating and cooling requirements in a chemical facility are often integrated, taking advantage of surplus energy in the process to reduce as much as possible the consumption of energy utilities.

This heat integration process is often carried out either at a thermodynamic level (through Pinch analysis) or at an economic and feasibility level (through more complex models such as Synheat from Yee and Grossmann, 1990). Both approaches consider a fixed set of process conditions (available and desired temperatures, heat content of streams) in order to estimate the minimum amount of utilities required in the process and the structure of the heat exchanging network required to do so.

These results, although insightful, assume fixed conditions of the processes being evaluated, which it is often not the case either because of their discontinuous nature or the unavoidable variability of process conditions due to process upsets or the required process control system. Thus, for a more realistic and effective design of heat integration strategies, these should account for the variability of process conditions.

The goal of this thesis is to, for a given case example, generate and analyze the heat integration results under uncertainty. This will be accomplished following 4 steps:

1. Define the uncertainties associated with the different variables affecting the heat integration of the process.
2. Find the optimal heat integration of the process for the base / average parameter values of the process.
3. Apply a Monte-Carlo (MC) approach to solve the heat integration optimization problems under uncertainty.
4. Analyze the obtained results and identify consistent heat integration configurations

This project will utilize data obtained from state-of-the-art simulation software like Aspen HYSYS or Aspen PLUS, using software optimization software GAMS.

This research aims to develop a more realistic methodology for the design of heat integration strategies for the chemical industry, ultimately contributing to the improvement of their energy efficiency and economic and environmental performance.

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