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AN INTEGRATED SOFTWARE FRAMEWORK FOR THE SIMULATION, MONITORING, DESIGN AND RETROFIT OF HEAT EXCHANGER NETWORKS SUBJECT TO FOULING

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ABSTRACT

Fouling in industrial heat exchangers is a major problem for the process industry worldwide that leads to increased operating costs, maintenance issues and environmental impact of operations. Existing software tools that assist engineers in the analysis, design, monitoring and prevention of heat exchangers and heat exchanger networks in the presence of fouling only focus on one or a subset of these aspects. They typically utilize simplifying assumptions that limit predictive capabilities within one utilization, and distinct assumptions for different applications (e.g. R&D, design, operations). As a result, work is duplicated in different engineering departments, there is no industry standard, models are not fully trusted and performance problems often arise across departments and functions. To address these problems, this paper presents a comprehensive framework that integrates the solution of monitoring, design and retrofit analysis of heat exchangers and their networks in a unified platform. At the core of the system, an advanced model allows the accurate calculations of time-varying fouling rates as a function of local conditions in the heat exchanger and fluid properties, accounting for the complex interactions between thermal and hydraulic aspects and equipment geometry.

Implemented in a user-friendly flowsheeting environment with state-of-the-art numerical solution methods and support of engineering workflows, this novel framework provides a consistent, robust and flexible system for the solution of engineering heat transfer fouling problems at all stages, from R&D to operations support.

A key benefit is the ability to consider and analyse, using consistent models and assumptions, the trade-offs between design and operational aspects. Some examples from industrial applications are presented. A second benefit is the ability of the simulation framework to work in conjunction with a state-of-the-art experimental facility for the actual measurement of crude oil fouling in conditions

close to those in the refinery, utilising advanced features such as parameter estimation from dynamic data. Again, some examples are presented.