The Data-Driven Gasketed Plate Heat Exchanger

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For a long time, the gasketed plate heat exchanger (GPHE) has been a faithful servant when it comes to heat transfer tasks. Its purpose is simple: to exchange heat between media flowing through the device. Industries such as pharmaceuticals, electronics, food and beverage (and many more) heavily depend on heat exchangers. However, as with all mechanical devices, it is subject to wear and tear. Needless to say, it cannot operate optimally throughout eternity. Therefore, it is essential to continuously monitor its performance to know its current state of health.

The GPHE is a very compact and isolated device, making it a challenge to find sensor devices that can be integrated with it. However, with the progression of sensor technology, there are multiple technologies that carry great promise for being integrated with the GPHE. Therefore, a critical part of the thesis was to investigate such methods. If such methods can effectively be implemented, there will be a whole new world of opportunities. All thanks to the possibility of being able to continuously monitor the GPHE's performance.

Furthermore, with the advent of big data and improved computational power, it is now possible to store and process vast amounts of data. Trying to manually go through such loads of data and explicitly program rules can quickly become complex and challenging to maintain. This is where machine learning comes in handy. By using appropriate machine learning models, important patterns and interactions in the data can be detected without any explicit programming. Ultimately, this can allow for predictions for the expected future performance. Suppose the predicted behavior indicates that something is not working right. In that case, preventative actions can be taken to prevent a complete device failure from happening. The ability to predict such a need for maintenance can lead to huge benefits such as reduced downtime, minimized labor costs, and increased safety.

The thesis shows that there are measurement methods that can collect data on essential flow parameters for the GPHE. Moreover, it also demonstrates several different predictive tests with the data acquired from the used sensor devices. Thus, the thesis shows that there are multiple ways to predict the performance of a GPHE. Although, much more work is needed to actualize a complete predictive maintenance system. However, the thesis provides a solid starting point for creating a truly data-driven gasketed plate heat exchanger.