Soft Sensor Solutions for Control of Oil Sands Processes

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The cost and environmental impacts associated with operation of oil sands processes can be reduced through improvement of process control systems. Online measurements of process quality variables constitute an essential prerequisite for process control systems. However, real-time monitoring of such variables is often restricted by inadequacy of measurement techniques. The key performance indicators are normally determined by offline laboratory analysis or online analyzers, which are often expensive and require frequent maintenance. Furthermore, significant delays associated with laboratory analysis or slowly-processed quality measurements of online analyzers can reduce the efficiency of control policies. Therefore, there has been a growing interest in the development of *inferential sensors* to provide frequent online estimates of key process variables on the basis of their correlation with real-time process measurements. Such predictive models devoted to improving control of oil sands processes can help in increasing energy efficiency, reducing environmental footprints, and lowering production costs of bitumen.

In the context of oil sands industry, development of inferential sensors entails unique challenges that arise due to the varying quality of operational and laboratory data. Multiple operation modes, measurement noise, missing values, outlying observations, and multi-rate data are the common factors affecting the quality of process data. This work provides a general introduction to the main steps involved in the design of inferential sensors. The key challenges associated with each step are described and some of the approaches proposed to deal with these issues are summarized. The effectiveness of the proposed methods is demonstrated through several successful applications in the oil sand industry.