Observer and data-driven model based fault detection in Power Plant Coal Mills - DTU Orbit (15/12/2018)

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This paper presents and compares model-based and data-driven fault detection approaches for coal mill systems. The first approach detects faults with an optimal unknown input observer developed from a simplified energy balance model. Due to the time-consuming effort in developing a first principles model with motor power as the controlled variable, data-driven methods for fault detection are also investigated. Regression models that represent normal operating conditions (NOCs) are developed with both static and dynamic principal component analysis and partial least squares methods. The residual between process measurement and the NOC model prediction is used for fault detection. A hybrid approach, where a data-driven model is employed to derive an optimal unknown input observer, is also implemented. The three methods are evaluated with case studies on coal mill data, which includes a fault caused by a blocked inlet pipe. All three approaches detect the fault as it emerges. The optimal unknown input observer approach is most robust, in that, it has no false positives. On the other hand, the data-driven approaches are more straightforward to implement, since they just require the selection of appropriate confidence limit to avoid false detection. The proposed hybrid approach is promising for systems where a first principles model is cumbersome to obtain.

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