

Abstract

The quantity and particle size distribution of pulverised coal supplied to combustion equipment downstream of coal pulverising plants are critical to achieving safe, reliable and efficient combustion. These two key performance indicators are largely dependent on the mechanical condition of the pulveriser. This study aimed to address the shortfalls associated with conventional time-based monitoring techniques by developing a comprehensive online pulveriser condition monitoring philosophy. A steady-state Mill Mass and Energy Balance (MMEB) model was developed from first principles for a commercial-scale coal pulveriser to predict the raw coal mass flow rate through the pulveriser. The MMEB model proved to be consistently accurate, predicting the coal mass flow rates to within 5 % of experimental data. The model proved to be dependent on several pulveriser process variables, some of which are not measured on a continuous basis. Therefore, the model can only function effectively on an industrial scale if it is supplemented with the necessary experiments to quantify unmeasured variables. Moreover, a Computational Fluid Dynamic (CFD) model based on the physical geometry of a coal pulveriser used in the power generation industry was developed to predict the static pressure drop across major internal components of the pulveriser as a function of the air flow through the pulveriser. Validation of the CFD model was assessed through the intensity of the correlation demonstrated between the experimentally determined and numerically calculated static pressure profiles. In this regard, an overall incongruity of less than 5 % was achieved. Candidate damage scenarios were simulated to assess the viability of employing the static pressure measurements as a means of detecting changes in mechanical pulveriser condition. Application of the validated pulveriser CFD model proved to be highly advantageous in identifying worn pulveriser components through statistical analysis of the static pressure drop measured across specific components, thereby demonstrating a significant benefit for industrial application.