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Trend extraction and identification method of cement burning zone flame temperature based on EMD and least square

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Abstract

The trend analysis of the temperature change of burning zone is very important for the normal production of cement clinker. In this paper, empirical mode decomposition (EMD) combined with the least square method is researched to realize the trend extraction and identification of cement burning zone flame temperature. Firstly, the temperature data is decomposed by EMD to obtain every intrinsic mode function (IMF) and the remainder. Then, the least square method is used to fit every IMF and the remainder. With the fitting error as the judgment criterion, the trend of the signal is extracted as the combination of the IMF components with less fitting error and the remainder. Further, the first derivative of the fitting function is used to determine the fundamental change in the trend of the signal, and the trend identification result is obtained. At last, the trend extraction and identification method is validated on the burning zone temperature data obtained from a cement company. The results show that the trend extraction and identification of the burning zone temperature based on EMD and least square is effective. More importantly, the method proposed in this paper can automatically determine the number of EMD decomposition layers. It does not have the problem of artificial selection of basis function and decomposition layers, and does not require empirical knowledge and complex experimental procedures for extracting trend item of burning zone temperature. This paper provides a feasible method for the extraction and identification of the burning zone temperature.

Keywords: burning zone temperature, trend extraction, empirical mode decomposition, trend identification, least square

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