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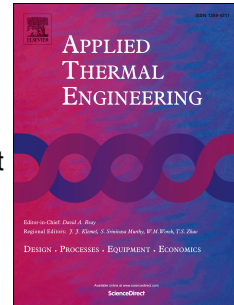
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Outliers Detection Method of Multiple Measuring Points of Parameters in Power Plant Units

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Abstract: A novel outlier detection method known as modified Grubbs method, which is based on median and median absolute deviation, is proposed to solve outlier detection in multiple measuring points' parameters. Weights are introduced to modify median absolute deviation and the test criterion. In the paper, a comparative study of the proposed method and the original Grubbs method in outlier detection on simulated data is presented. Due to the shortcomings of the original Grubbs method, the modified Grubbs method is a more robust alternative. The performances of the proposed method are illustrated by main steam temperature data set with and without outliers. The obtained results demonstrate that the proposed method can be used in outlier detection in thermal power plants and it is highly efficient and robust.

Keywords: modified Grubbs method; multiple measuring points; outliers; robust; thermal power units

1 Introduction

In complex thermal power system of power plant, a lot of parameters are important for the safe operation of power plant units and for the improvement of the units' economy. The accuracy of parameters is the base of optimal operation, on-line monitoring and fault diagnosing. Because of sensor fault and large disturbance and so forth, some measuring points may be distorted. So in order to ensure the accuracy of these parameters, some parameters are installed with multiple measuring points.

Most parameters in power plant general layout one to four measuring points, and parameters that have more than four measuring points are relatively few. For example, the main steam temperature, main steam pressure, superheater temperature usually have four measuring points. According to the number of measuring points, the parameters can be divided into three kinds, that is, parameters of single measuring point (SMP), parameters of double measuring points (DMP), and parameters of multiple measuring points (MMP) (no less than three).

On account of gross recording, sensor fault or measurement errors, there may be outliers or extreme data among multiple measuring points, which will lead the observed value of the parameter to deviate from its real value. So outlier detection methods are needed to apply on the data before doing further analysis. Detecting outlier has always been a challenging problem for researchers, and Grubbs method remains the common method to do outlier detection, which usually uses the mean plus or minus three standard deviations as testing criterion [1]. Even some researchers even do not handle outliers before modeling based on the data set. Jin [2] used original Grubbs method to do outlier detection on multiple measuring points in thermal power unit and Gao et al. [3] applied modified Grubbs method on multiple measuring points, but the method is still based on mean. Simmons et al. [4] pointed out the importance of detecting outliers and also pointed out that many researchers incorrectly use statistical methods to detect outliers. In some cases, the mean plus or minus three standard deviations around mean is a very poor indicator to detect outliers as Cousineau et al. [5] described, because the influence of outliers is more important if the sample size is small and the indicator is less robust. Leys et al. [6] presented median absolute deviation method as an alternative and robust way of dealing with outliers rather than using standard deviation around mean.

According to the above research, the paper focuses on parameters with multiple measuring points, meanwhile the problem about multiple measuring points of parameters in

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