DETEKSI KESALAHAN OSILASI DENGAN PENYEBAB STIKSI MENGGUNAKAN CONVONTIONAL NEURAL NETWORK PADA KONTROL PROSES INDUSTRI

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INTISARI

Penggunaan *machine learning* (ML) dalam analisis deteksi kesalahan osilasi kontrol semakin banyak digunakan. Osilasi pada proses industri menjadi salah satu masalah yang paling sering muncul terutama pada kontrol proses hingga 30% dan 41% dari masalah kontrol proses. Masalah ini dapat sangat merugikan pabrik karena mengganggu operasional pabrik, meningkatkan variabilitas dalam kualitas produk, mempercepat keausan peralatan, dan mengakibatkan konsumsi energi dan bahan baku yang berlebih. Beberapa studi sudah dilakukan untuk mengatasi masalah kesalahan kontrol yang disebabkan oleh osilasi. Dalam beberapa studi yang dipelajari, beberapa teknik ML sudah digunakan antara lain dengan menggunakan arsitektur *Random Forest*, *Moving Window* hingga *Neural Network* .

Teknik *Neural Network* sendiri ada beberapa yang mulai dikembangkan untuk proses deteksi kesalahan osilasi antara lain dengan *multilayer perceptron* (MLP) *feed forward* (FF), *Convulational Neural Network* (CNN) dan *Recurrent Neural Network* (RNN). Pada studi ini akan digunakan arsitektur CNN dengan mengamati pola perubahan antara signal output (OP) kontrol terhadap keluaran dari kontrol *Process Value* (PV) yang ditunjukkan oleh diagram PV(OP). Teknik ini dipilih karena metode deteksinya sederhana dan hanya membutuhkan dua parameter. Hasil model deteksi menunjukkan sistem sangat baik digunakan untuk kesalahan yang terjadi pada kontrol proses. Dari hasil penelitian penerapan ML pada model pengenalan pola bisa menaikkan akurasi model deteksi hingga hampir 90% Tulisan ini diharapkan dapat memberikan gambaran tentang karakterisktik ML dan penerapannya untuk deteksi dan diagnosis osilasi kontrol pada proses industri.

Kata kunci: *convulational neural network, machine learning,* deteksi, stiksi

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OSCILLATION FAULT DETECTION WITH THE STICTION CAUSE USING CONVOLUTIONAL NEURAL NETWORK IN INDUSTRIAL PROCESS CONTROL

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ABSTRACT

The use of machine learning (ML) in the analysis of control oscillation fault detection is increasingly being used. Oscillations in industrial processes are one of the most frequent problems, especially in process control up to 30% and 41% of process control problems. This problem can be very costly for a factory by disrupting plant operations, increasing variability in product quality, accelerating equipment wear, and resulting in excess consumption of energy and raw materials. Several studies have been conducted to overcome the problem of control errors caused by oscillations. In several studies studied, several ML techniques have been used, including using the Random Forest architecture, Moving Window to Neural Network (NN).

There are several NN techniques that have been developed for the oscillation error detection process, including multilayer perceptron (MLP) feed forward (FF), Convulational Neural Network (CNN) and Recurrent Neural Network (RNN). In this study, the CNN architecture will be used by observing the pattern of changes between the output signal (OP) of the control and the output of the Process Value (PV) control shown by the PV(OP) diagram. This technique was chosen because the detection method is simple and only requires two parameters. The results of the detection system show that the system is very well used for errors that occur in process control. From the research results, the application of ML in pattern recognition systems can increase the accuracy of detection systems until almost up to 90%. This paper is expected to provide an overview of the characteristics of ML and its application for the detection and diagnosis of control oscillations in industrial processes.

Keywords: convulational neural network, machine learning, pattern recognition, stiction

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