Desain Pengendali Sistem Pressure Process Rig Menggunakan Kendali Inverse Langsung dan Single Neuron PID Berbasis Backpropagation Neural Network = Design of Pressure Process Rig System Controller Using Direct Inverse Control and Single Neuron PID Based on Backpropagation Neural Network

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Abstrak

Perkembangan kecerdasan buatan (artificial intelligence/AI) bergerak semakin cepat dan mengalami kemajuan pesat dalam setiap bidang kehidupan manusia, tak terkecuali dalam dunia kendali industri. Sementara kendali industri mensyaratkan sistem pengendali yang mampu mengatasi perubahan karakteristik secara otomatis serta dapat beradaptasi dengan dinamika perubahan sistem yang diakibatkan adanya perubahan kondisi lingkungan kerja. Pengendali berbasis kecerdasan buatan dianggap mampu untuk beradaptasi dengan perubahan karakteristik dari sistem secara otomatis adalah pengendali berbasis neural network. Dalam penelitian ini disajikan desain dan simulasi sistem pengendali berbasis neural network dengan metode pembelajaran back propagation yaitu pengendali inverse langsung(direct inverse control/DIC), pengendali neuron tunggal(single neuron controller), serta pengendali PID pada plant modul training pressure process rig(PPR 38-417). Untuk pengujiannya, didesain sistem identifikasi berbasis neural network sebagai simulator plant. Hasilnya, semua sistem kendali yang didesain tersebut mampu mengendalikan plant sesuai dengan sinyal referensi yang dinginkan. Namun pengendali single neuron dan PID mampu mempertahankan keluarannya dengan baik saat diberi gangguan pada sinyal kendali maupun plant dibandingkan dengan pengendali inverse langsung(ANN-DIC). Hal ini dikarenakan kendali single neuron dan PID bersifat close loop sehingga mampu mengkoreksi kesalahan secara langsung. Sementara jika dibandingkan dengan kendali PID, kendali single neuron lebih adaptif untuk berbagai kondisi gangguan karena memiliki metode pembelajaran langsung, sementara kendali PID perlu dilakukan tunning untuk mendapatkan unjuk kerja yang handal. <hr /> The development of artificial intelligence (AI) is moving faster and experiencing rapid progress in every area of human life, not least in the world of industrial control. While industrial control requires a control system that is able to overcome changes in characteristics automatically and can adapt to the dynamics of system changes caused by changes in working environment conditions. Artificial intelligence-based controllers are considered capable of adapting to changes in the characteristics of the system automatically is a neural network-based controller. In this study, the design and simulation of a neural network-based controller system with back propagation learning methods, namely direct inverse control (DIC) and single neuron controller, as well as PID controllers for the pressure process rig (PPR 38-417) training module. For the test, a neural network-based identification system is designed as a simulator plant. As a result, all the control systems designed are able to control the plant in accordance with the desired reference signal. However, single neuron and PID controllers are able to maintain their output well when given interference with the control signal or plant compared to the direct inverse controller (ANN-DIC). This is because single neuron control and PID are close loop so that they can correct errors directly.

Meanwhile, when compared to PID control, single neuron control is more adaptive for a variety of disruption conditions because it has a direct learning method, while PID control needs to be tuned to get reliable performance.</p>