Peningkatan Kinerja Pengendalian Proses Produksi Formaldehida di PT X Menggunakan Multivariable Model Predictive Control = Improvement of Formaldehyde Production Process Control in PT X using Multivariable Model Predictive Control

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Abstrak

ABSTRAK
Formaldehida merupakan senyawa kimia yang digunakan pada industri perekat. PT X merupakan produsen formaldehida di Jawa Timur. Sistem pengendali proses yang digunakan di PT X masih berbasis proportional integral (PI). Pengendali konvensional ini masih memiliki kekurangan. Multivariable model predictive control (MMPC) diajukan untuk meningkatkan kinerja sistem pengendali pada PT X. Model empiris dibuat menggunakan process reaction curve (PRC) dan perhitungan parameter first order plus dead time (FOPDT). Empat manipulated variable (MV) dan empat controlled variable (CV) membentuk 16 model empiris. Perhitungan parameter MMPC, meliputi sample time (T), prediction horizon (P), control horizon (M), dilakukan dengan metode Shridhar dan Cooper (1998) dan dioptimalkan dengan metode fine tuning. Kinerja pengendalian MMPC diuji dengan perubahan set point (SP) dan ketahanan atas gangguan (disturbance rejection). Empat pengendali yang diuji, yaitu pengendali tekanan evaporator (PIC-101), pengendali liquid percent level evaporator (LIC-101), pengendali laju alir steam (FIC-102), dan pengendali suhu udara (TIC-101). Nilai parameter MMPC meliputi T, P, dan M yang optimal berturut turut adalah 3, 62, dan 2. Pengendali MMPC dapat memberikan peningkatan kinerja pengendalian pada uji SP tracking dengan rata rata sebesar 33,24% untuk IAE dan 42,93% untuk ISE. Sedangkan, pada uji disturbance rejection, terdapat peningkatan kinerja dengan rata-rata sebesar 33,48% untuk IAE dan 58,08% untuk ISE.
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<i>ABSTRACT
Formaldehyde is chemical substances that is used in adhesive industry. PT X is formaldehyde producer in East Java. PT X is using proportional integral based control system. This conventional controller has several weaknesses. Multivariable model predictive control (MMPC) is used to increase the performance of control system at PT X. Empirical model is made with process reaction curve (PRC) followed by first order plus dead time (FOPDT) calculation. Four manipulated variable (MV) and four controlled variable (CV) will construct 16 empirical models. Calculation of MMPC parameter, which include sample time (T), prediction horizon (P), and control horizon (M), is done with Shridhar and Cooper method (1998) and optimized by fine tuning method. Performance of MMPC is tested by set point changes and disturbance rejection. Four controllers tested are evaporator pressure control (PIC-101), liquid percent level control (LIC-101), steam flow control (FIC-102), and air temperature control (TIC-101). The optimized parameter of MMPC which include T, P, and M are 3, 62, and 2 respectively. MMPC Controller can increase controller performance in SP tracking with average number of 33.24% for IAE and 42.93% of ISE. Meanwhile, in disturbance rejection, there is an increase in average of 33.485 for IAE and 58.08% for ISE.<i/>