

ABSTRAK

Sistem hidrolik memiliki peran penting dalam industri, khususnya pada proses *press brake bending* plat aluminium untuk pembuatan asbak yang memerlukan akurasi dan konsistensi tekanan. Kesalahan pengaturan tekanan dapat menyebabkan cacat seperti deformasi dan retakan. Untuk mengatasi hal ini, digunakan kontrol *Proportional Integral Derivative* (PID) untuk menstabilkan tekanan dan *Genetic Algorithm* (GA) untuk mengoptimalkan parameter PID. Plat aluminium yang digunakan memiliki ketebalan 1 mm, 2 mm, dan 3 mm. Sensor *Time of Flight* (ToF) dengan tipe VL53L0X yang digunakan untuk mengukur ketebalan plat aluminium, sementara sensor tekanan induktif G1/4 mengukur tekanan *fluida* yang mengalir secara *real-time*. Aktuator berupa motor *stepper* mengontrol *pressure reducing valve*, membentuk sistem kontrol *loop* tertutup untuk menjaga tekanan tetap stabil. Hasil pengujian menunjukkan bahwa optimasi PID menggunakan GA menghasilkan *error* antara 0,23% hingga 1,31%, waktu proses (*settling time*) antara 1,7 hingga 5,2 detik, dan *overshoot* antara 2,8% hingga 5%. Penerapan GA dalam optimasi PID meningkatkan performa sistem secara signifikan, sehingga menjadi solusi potensial untuk sistem *pressing* yang lebih efisien dan berkualitas di industri manufaktur.

Kata kunci: Tekanan hidrolik, sensor *Time of Flight* (ToF), sensor tekanan induktif, motor *stepper*, *press brake bending*, PID, *Genetic Algorithm*.

ABSTRACT

The hydraulic system plays a crucial role in industry, particularly in the press brake bending process of aluminum plates for ashtray manufacturing, which requires accuracy and pressure consistency. Errors in pressure regulation can lead to defects such as deformation and cracking. To address this issue, a Proportional Integral Derivative (PID) controller is applied to stabilize the pressure, while a Genetic Algorithm (GA) is employed to optimize the PID parameters. The aluminum plates used have thicknesses of 1 mm, 2 mm, and 3 mm. A Time of Flight (ToF) sensor, type VL53L0X, is utilized to measure the thickness of the aluminum plates, whereas an inductive G1/4 pressure sensor measures the real-time fluid pressure. The actuator in the form of a stepper motor controls the pressure reducing valve, forming a closed-loop control system to maintain stable pressure. Experimental results show that PID optimization using GA yields an error between 0.23% and 1.31%, a settling time ranging from 1.7 to 5.2 seconds, and an overshoot between 2.8% and 5%. The implementation of GA in PID optimization significantly enhances system performance, making it a potential solution for more efficient and high-quality pressing systems in the manufacturing industry.

Keywords: *Hydraulic pressure, Time of Flight (ToF) sensor, inductive pressure sensor, stepper motor, press brake bending, PID, Genetic Algorithm.*