

## DAFTAR ISI

HALAMAN NOMOR PERSOALAN.....	ii
LEMBAR PENGESAHAN .....	iii
PERNYATAAN BEBAS PLAGIASI.....	iv
SURAT PERNYATAAN KEBENARAN DOKUMEN .....	v
KATA PENGANTAR.....	vi
<i>ABSTRACT</i> .....	viii
INTISARI.....	ix
DAFTAR ISI .....	x
DAFTAR GAMBAR .....	xiii
DAFTAR TABEL.....	xiv
BAB I PENDAHULUAN .....	1
1.1 Latar Belakang .....	1
1.2 Rumusan Masalah .....	2
1.3 Tujuan.....	3
1.4 Batasan Masalah.....	3
1.5 Manfaat Penelitian.....	3
BAB II TINJAUAN PUSTAKA DAN DASAR TEORI .....	5
2.1 Penelitian Terdahulu .....	5
2.2 Sistem Suspensi.....	7
2.3 Sistem Elektro-Hidrolik .....	9
2.4.1 Pompa Hidrolik .....	10
2.4.2 Katup Proporsional.....	11
2.4.3 Aktuator (Silinder Hidrolik).....	12

2.4.4 <i>Proportional Amplifier</i> .....	14
2.4.5 <i>Sensor Displacement</i> .....	15
2.4 Sistem Kendali .....	16
2.4.1 Transformasi <i>Laplace</i> , Fungsi Transfer, dan Blok Diagram .....	16
2.4.2 <i>Proportional Integral Derivative (PID)</i> .....	18
2.4.3 <i>Mean Absolute Percentage Error (MAPE)</i> .....	21
2.5 <i>Particle Swarm Optimization (PSO)</i> .....	22
2.5.1 Algoritma <i>Classic PSO</i> .....	23
2.5.2 Algoritma <i>Adaptive Comprehensive Learning PSO (ACLPSO)</i> .....	26
2.5.3 Algoritma <i>Constriction PSO</i> .....	29
2.5.4 <i>Fitness Function</i> .....	29
2.5.5 <i>PID Tuning</i> dengan Algoritma PSO .....	30
BAB III METODE PENELITIAN.....	32
3.1 Diagram Alir Penelitian.....	32
3.2 Perancangan Sistem Kendali Alat Uji <i>Dynamic Fatigue</i> .....	34
3.2.1 <i>Proportional Amplifier</i> .....	36
3.2.2 Katup Proporsional.....	36
3.2.3 Silinder Hidrolik.....	36
3.2.4 <i>Sensor Displacement</i> .....	42
3.3 Metode <i>Particle Sward Optimization (PSO)</i> .....	43
3.4 Simulasi Dinamis Alat Uji <i>Dynamic Fatigue</i> .....	45
3.5 Rancangan Elektro-hidrolik Alat Uji <i>Dynamic Fatigue</i> .....	46
BAB IV HASIL DAN PEMBAHASAN.....	48
4.1 Perancangan Sistem Hidrolik .....	48
4.1.1 Komponen Sistem Kendali.....	48

4.1.2 Desain Alat Uji <i>Dynamic Fatigue</i> .....	50
4.2 Pengaturan Parameter Simulasi.....	51
4.3 Perancangan Sistem Kendali .....	55
4.3.1 Perhitungan Fungsi Transfer .....	55
4.3.2 Respons Sistem .....	55
4.4 Pemilihan Metode <i>Particle Swarm Optimization (PSO)</i> .....	57
4.5 Simulasi Dinamis <i>Particle Swarm Optimization (PSO) PID Tuning</i> .....	60
BAB V KESIMPULAN DAN SARAN.....	67
5.1 Kesimpulan.....	67
5.2 Saran.....	68
DAFTAR PUSTAKA .....	69
LAMPIRAN.....	73
Lampiran 1. Silinder Hidrolik .....	73
Lampiran 2. Pompa Hidrolik.....	76
Lampiran 3. Katup Proporsional .....	77
Lampiran 4. <i>Proportional Amplifier</i> .....	79
Lampiran 5. <i>Pressure Relief Valve</i> .....	80
Lampiran 6. Motor Hidrolik.....	81
Lampiran 7. Sensor <i>Displacement</i> .....	83
Lampiran 8. <i>Programmable Logic Controller (PLC)</i> .....	85
Lampiran 9. Fluida .....	86