

Chapter One

Introduction

1.1 General

The hydramatic Division of the General Motors Corporation specified the design criteria for the first programmable controller in 1968. Their primary goal was to eliminate the high costs associated with inflexible, relay controlled systems. The first Programmable Logic Controllers (PLCs) offered relay functionality, thus replacing the original hardwired relay logic, which used electrically operated devices to mechanically switch electrical circuits. They met the requirements of modularity, expandability, programmability, and ease of use in an industrial environment. These controllers were easily installed, used less space, and were reusable. The controller programming, although a little tedious, had a recognizable plant standard: the ladder diagram format. By 1971, PLCs were being used to provide relay replacement. The first programmable controllers were more or less just relay replacers. Their primary function was to perform the sequential operations that were previously implemented with relays. These operations included ON/OFF control of machines and processes that required repetitive operations. However, these programmable controllers were a vast improvement over relays. If system requirements call for flexibility or future growth, a programmable controller brings returns that outweigh any initial cost advantage of a relay control system. Even in a case where no flexibility or future expansion is required, a large system can benefit tremendously from the troubleshooting and maintenance aids provided by a PLC. The extremely short cycle (scan) time of a PLC allows the productivity of machines that were previously under electromechanical control to increase considerably. Also, although relay control may cost less initially, this advantage is lost if production downtime due to failures is high. In general, PLC architecture is modular and flexible, allowing hardware and software elements to expand as

the application requirements change. In the event that an application outgrows the limitations of the programmable controller, the unit can be easily replaced with a unit having greater memory and Input/Output (I/O) capacity, and the old hardware can be reused for a smaller application. A PLC system provides many benefits to control solutions, from reliability and repeatability to programmability. The PLC uses in oil field, pipeline pump station control, chemical batching, rubber production, plastic injection molding and ECT [1].

1.2 Problem Statement

The chemical process, refining process for gasoline and paper machine are continuous process. Control of these processes cannot be accomplished fast enough by PLC control. Also analog PLC control is not effective or fast enough by PLC ON-OFF control. The control system most often used in a continuous process is to use PID. Many medium size PLC and all large PLCs have PID control faster which are able to accomplish process control effectively.

1.3 Objectives

The main objectives of this study are listed as:

1. To study hydraulic pump.
2. To understand the PLC and PID theories.
3. To model complete system using ladder diagram.
4. To evaluate the performance of the hydraulic pump.

1.4 Methodology

1. Study the previous works.
2. Understand ladder program and how to use.
3. Build the complete simulation system.
4. Evaluate the performance based on simulation results.

1.5 Thesis layout

Chapter one: presents Background, Problem statement, Objectives, Methodology and thesis layout.

Chapter two: gives background theory of PLC, including: PLC type's architecture, operation systems and application programs and PID controller theory.

Chapter three: the basic concept of hydraulic system implementation is briefly reviewed. The applications of hydraulic systems are addressed. Furthermore, the design of hydraulic systems is discussed. Finally, the PLC ladder program is introduced.

Chapter four: presents the simulation results and discussions.

Chapter five: provides conclusions and recommendations.