SPEED CONTROL OF DC MOTOR USING PID CONTROLLER

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Abstract— The objective of this paper is to control the speed of a motor using PID controller. The PID controller is generated by an arduino program and used in the speed control of motor. Arduino is an open-source electronic prototyping platform based on flexible easy to use hardware and software. It is intended for artists, designers, hobbyists and anyone interested in creating interactive objects or environments. Ardino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling motors. The microcontroller on the board is programmed using the arduino programming language (based on wiring) and the arduino development (based on processing). Arduino projects can be stand alone or they can communicate with software running on the computer. The arduino language program is dumped into the microcontroller and it is given to the analog input of microcontroller and the analog outputs are connected to PID controller. The speed of the motor will be controlled based on the PID controller and the speed sensed through Encoder would be compared with the reference value and obtained error is projected over PID controller and the process continues till we get minimum errors.

1. INTRODUCTION

PID controller is becoming very important in the last few years as demand is increasing from various process industries in order to maintain the consistency and maintain the output even after there is change in the input.

The DC motor has been popular in the industry control area for a long time, because they have many good characteristics, for example: high start torque characteristics, high response performance and easier to be linear control. DC motor has a good speed control respondence, wide speed control range And it is widely used in speed control systems which need high control requirements, such as rolling mill, double-hulled tanker, high precision digital tools, etc. The Organization of the paper is, section 1 describes the introduction with the highlighted view of an objectives of the work which is to be Carried out in this paper. Section 2 is based on Methodology of this paper also discussed the block diagram and describes the performance evaluation of system. Section 3 deals with the Experimental results and discussion. Section 4 deals with the conclusions.

II. PROPOSED METHODOLOGY

The proposed work is focused on controlling the speed of dc motor with different controller. The Various steps involved are explained below.

2.1 Open Loop Control System

Any physical system which does not automatically correct for variation in its output is called an open-loop system. In these systems the output remains constant for a constant input signal provided the external conditions remain unaltered. The output may be changed to any desired value by approximately changing the input signal but variations in external conditions may cause the output to vary from the desired value in an uncontrollable fashion.

2.2. Closed Loop Control System

A closed-loop control system is one in which an input forcing function is determined in part by the system response. The measured response of a physical system is compared with a desired response. The difference between these two responses initiates actions that will result in the actual response.

2.3. Proportional Controller

As the name suggests, a proportional controller applies power to the heater in proportion to the difference in temperature between the output and the reference. Thus, the P term is referred to as the proportional gain of the controller. On its own, the characteristic of the resulting output temperature will be such that it will typically stabilize just below the desired reference temperature. This is so because; as its gain is increased, the system responds by applying more power to the output, and as a result the temperature rises quickly and approaches closer to the set-point. But as this happens, the system will react by lowering the gain since the gap to the reference is now getting smaller. This causes the response to become progressively under-damped as the output temperature gets closer to the set-point. This difference between the stabilized output and the reference is called the Steady State Error

2.4 Integral Controller

To resolve the issue of the steady state error with Kp alone, the integral term, Ki, has to be used. The characteristic of the integral control is that it performs an integration of the past error values and applies a
gain to minimize this error. The effect of this action is that it changes the heater power continuously based on past performance until the time-averaged value of the temperature error is zero.

2.5 Derivative Controller
The derivative term comes into play when the overshoot and oscillation need to be addressed. The rate of change of the error is calculated by determining the slope of the error over time and multiplying this rate of change by the derivative gain \( K_d \). The magnitude derivative term introduces damping to the overall system output by slowing down the rate of change of the controller output such that the overshoot and oscillation can be reduced. But one side effect is that the damping may also increase the rise time slightly. Together with P and I control terms, the derivative term can help to improve the process stability of the system.

2.6 PID Controller
PID controller algorithm, the controller can provide control action designed for specific process requirements. The response of the controller can be described in terms of the responsiveness of the controller to an error, the degree to which the controller overshoots the set-point and the degree of system oscillation. Note that the use of the PID algorithm for control does not guarantee optimal control of the system or system stability.

III. EXPERIMENTAL RESULTS
The results are tested for the transfer function And there output response are as shown below.

CONCLUSION
The proposed work consists of a dc motor with different controller to control it, with different controlling options such as p, pi, pid. summarizing we can say that the PID controller process is one of best controlling method for any controlling system based on the comparison of the results obtained during the design process. As controlling the system is one of the biggest challenges in today’s scenario the proposed is one of the best solution for it.

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