A COMPARISON METHOD OF PID TUNING ON WARD-LEONARD DC COMPOUND MOTOR

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ABSTRACT

This paper compared three methods of PID tuning, Ziegler-Nichols, Chien, Hrones and Reswick and Chien et. al. by changing the set value of DC compound motor. The open-loop control system observed the optimum parameters for PID tuning to control the speed of Ward-Leonard DC compound motor. The methods developed based on the open-loop tuning rules and tangent method to calculate the vital parameters from the process control, which is process gain, dead time, reaction time and tangent.

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CHAPTER 1

INTRODUCTION

1.1 Background

Industrial applications use dc motors because the speed-torque relationship can be varied to almost any useful form for both dc motor and regeneration applications. Dynamic braking (dc motor-generated energy is fed to a resistor grid) or regenerative braking (dc motor-generated energy is fed back into the dc motor supply) can be obtained with dc motors on applications requiring quick stops, thus eliminating the need for, or reducing the size of, a mechanical brake.

In 1896, Harry Ward-Leonard proposed variable speed drive in which DC generator driven by diesel engine provided DC supply for motor. Ward-Leonard speed control is a system to control the speed of a direct-current motor in which the armature voltage of a separately excited direct-current motor is controlled by a motor-generator set.

Dc motors feature a speed, which can be controlled smoothly down to zero, immediately followed by acceleration in the opposite direction, without power circuit switching. And dc motors respond quickly to changes in control signals due to the dc motor's high ratio of torque to inertia. Control is obtained by weakening the shunt-field current of the dc motor to increase speed and to reduce output torque for a given armature current.

Recently, microprocessor-based digital control systems have replaced analogue controllers in many applications increased sophistication of operation, facilitating use of other types of machine such as stepper motor and switched reluctance motor. The aid introduction of digital control systems made the controllers as an integral part of the feedback control system that have many advantages such as greater precision, flexibility, consistency, stability, noise immunity and speed stability. Digital systems also enable precise speed matching or controlled speed ratios between two or more motors by use of common speed reference.