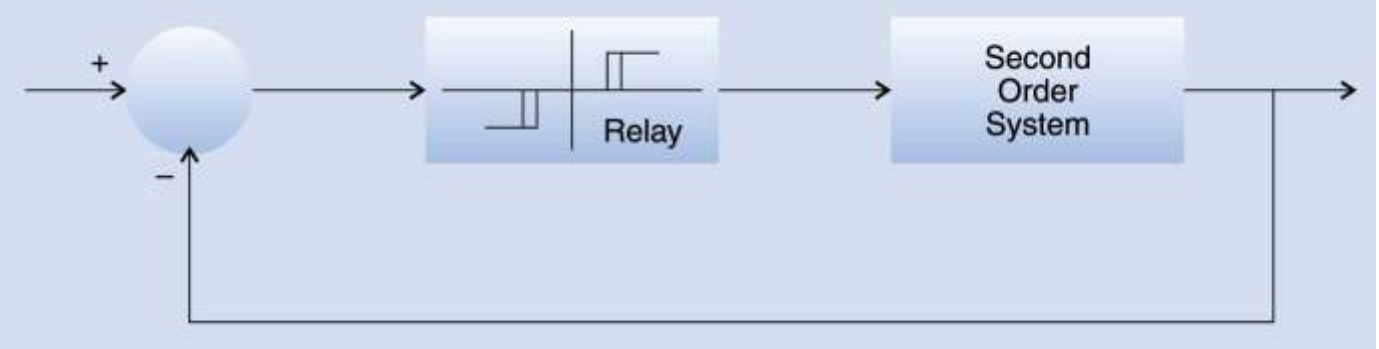
- **System with electronic relay**
- **Adjustable hysterisis and dead zone**
- **Display phase plane diagram on CRO**
- **Stability study by describing function method**

Introduction

Most physical systems are nonlinear to some extent, however, for purpose of analysis and design these are taken as nearly linear. In a few systems nonlinear elements are deliberately introduced to get some specific advantage. One such system is a relay control system, often referred to as bangbang or ON-OFF system. The controller in such a system is replaced by a power relay resulting in a substantial cost reduction. In the present unit a simulated second order system is controlled by an electronic relay. Apart from a study of the relay characteristics the experiment introduces the concept of Describing Function. Finally the phase plane method of analysis is covered in detail where the switching trajectories can be displayed on an X-Y oscilloscope. Figures below give the block diagram of the feedback system and the characteristics of the simulated relay.

The accompanying literature covers a brief treatment of the nonlinear system analysis through Describing Function and Phase Plane methods.

Steps for conducting various experiments are described along with sample test results.



Experiments

- Study of the relay characteristics and display of the same on CRO for different values of hysteresis and dead zones. Hysteresis and dead zone of the built-in 3-position electronic relay are Application software is included for demonstration and also for use as a set of subroutines Study of the effect of inertial and frictional loading on the dynamic performance
- Study of the effect of hysteresis on system stability. Sustained oscillations may occur in the system under various conditions, especially where hysteresis is present. The amplitude and frequency of such oscillations are predicted from a graphical analysis and then verified experimentally on the unit
- Phase plane analysis of relay control system for various values of Hysterisis and Dead Zones. The nature of the singular point in the phase plane diagram has importance in the stability studies of nonlinear systems. Here the phase trajectory is viewed on the CRO and the effect of changing hysteresis and dead zone observed

Note: Specifications are subject to change.

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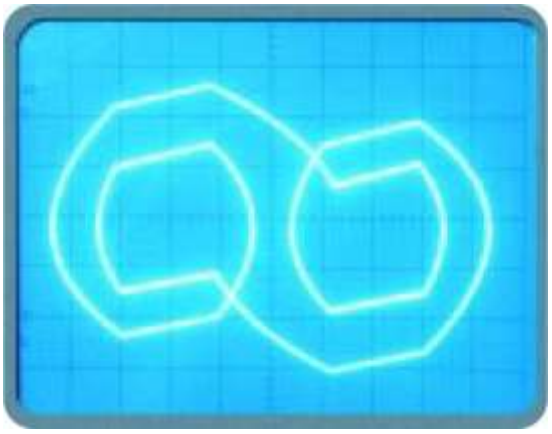
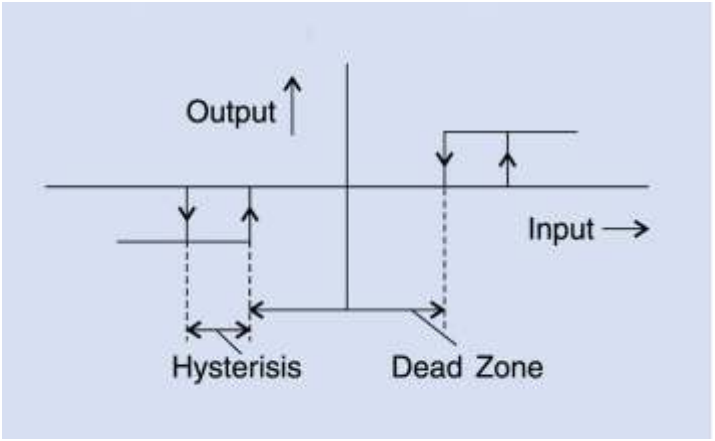
Features and Specifications

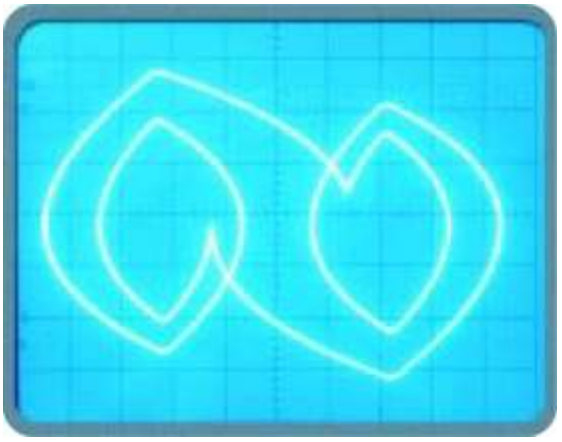
- Simulated electronic relay using high speed IC's
- Simulated 2nd order linear plant. Facility for displaying x and x signals
- Dead zone variable from 0-600mV (approx.)
- Hysteresis variable from 0-500mV (approx.)
- Built-in signal sources – sine and square
  Amplitude : 0-1V (min.) Variable
  Frequency: 10, 20, 40, 80, 100, 200, 400, 800 and 1000Hz
- IC regulated internal power supplies
- 220V±10%, 50Hz mains operation
- Literature and patch cords included
- Essential accessory - a dual beam CRO



Relay with deadzone

Relay Characteristics





Linear system

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