AC Position Control System

ELP225

Overview

- Introduction and Motivation
- Objectives
- Block diagram
- Working principle
- Questions

Introduction and Motivation

- Servosystems have wide applications in automated industries, spacecrafts, missiles, robots etc...

- An AC servomotor is a two phase AC motor. It consist of a reference winding and control winding which are placed 90 degree mechanically in space, and supplied with voltages phase shifted by 90 degree.

- The torque produced in the motor is controlled by adjusting the control winding voltage.

- In AC position control system, AC servomotor is controlled in closed loop mode, by using either position feedback or velocity feedback or the combination of both.

Objectives

- To understand the working principle of two phase AC servomotor.
- To familiarize with AC position control system.
- To understand the effects of position and velocity feedback on system dynamics.
- To understand the use of synchro as a position sensor in servo systems.
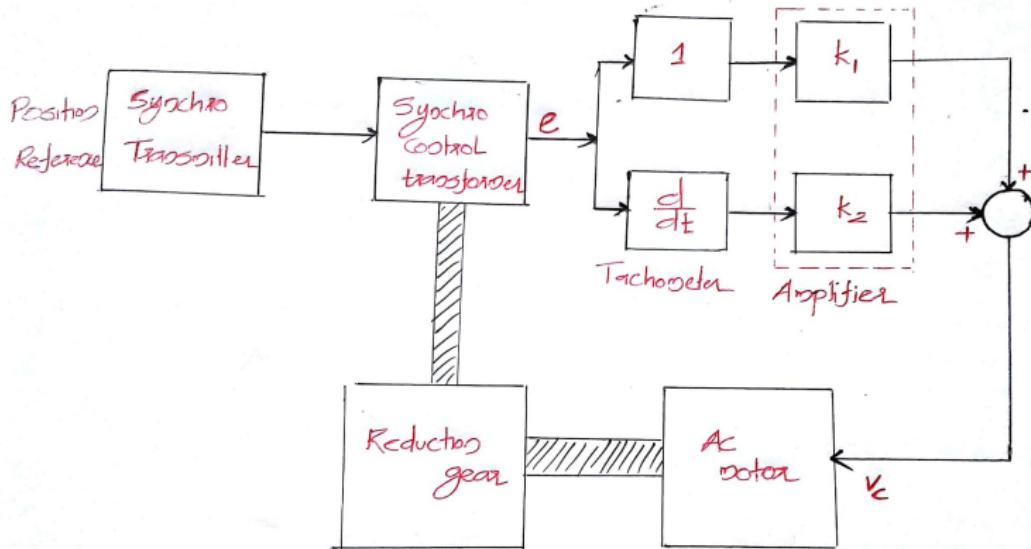
Block diagram

Figure: AC Position control system
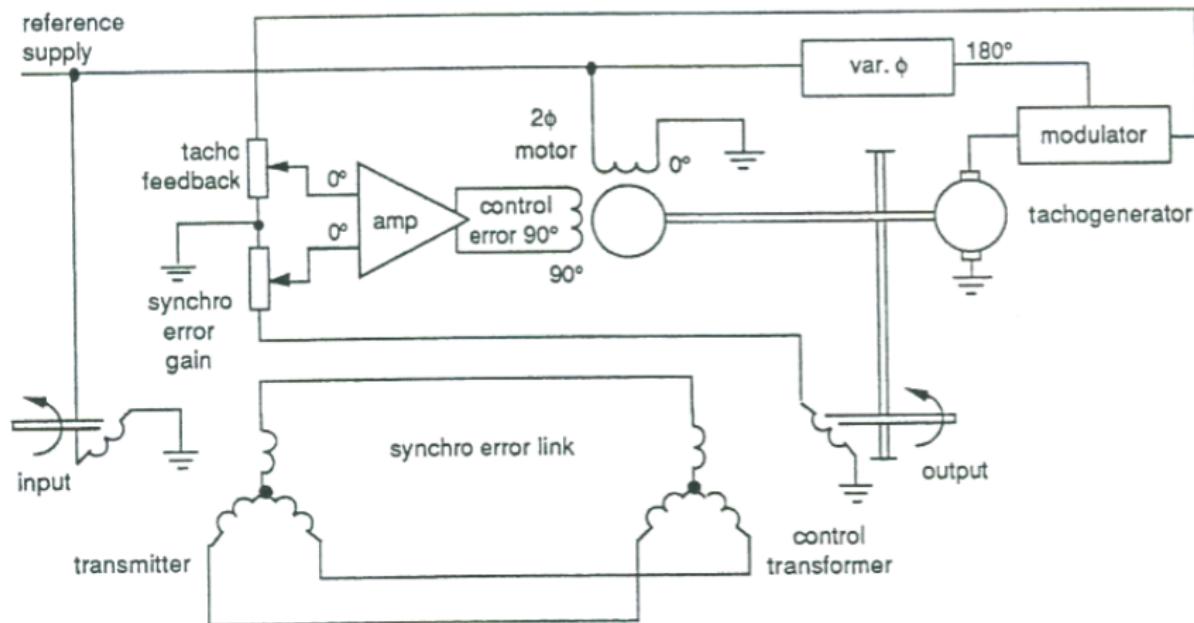
Figure: AC Position control system layout

Working principle

- Corresponding to the change in reference position (position of synchro transmitter rotor), an error voltage with amplitude 'e' is produced at control transformer rotor.

- In position feedback this error voltage is amplified and given to control winding, i.e

$$v_c = k_1 e \qquad (1)$$

- In position plus velocity feedback the error voltage and it's derivative is used for feedback, i.e

$$v_c = k_1 e + k_2 \frac{d}{dt} e \qquad (2)$$

- Torque produced by AC servomotor is directly proportional to control winding voltage. Hence the rotor of servomotor starts move towards the reference position.

Questions

- Explain servosystem and servomotor ?
- What is the torque equation for a two phase AC servo motor ?
- Find the closed loop transfer function of AC position control system ?
- How the velocity feedback influences the system dynamics. Explain the effect of velocity feedback during transient and steady state ?
- How can we use the combination of position and velocity feedback to implement state feedback in second order mechanical systems ?
- What are the applications of AC position control system ?