**Birzeit University-Faculty of Engineering**

**Electrical Engineering Department**

**EE3302-Control Systems**

**Inst.: J. Siam Assignment: Control using MatLab 2nd semester 2022**

Antenna Azimuth: An Introduction to Position Control Systems

A position control system converts a position input command to a position output response. Position control systems find widespread applications in antennas, robot arms, and computer disk drives. The radio telescope antenna in the following figures is one example of a system that uses position control systems. The discussion here will be on a qualitative level, with the objective of getting an intuitive feeling for the systems with which we will be dealing.

An antenna azimuth position control system lay out, schematic, and block diagrams are shown in Fig.1 where, the functions are shown above the blocks, and the required hardware is indicated inside the blocks. The purpose of this system is to have the azimuth angle output of the antenna, follow the input angle of the potentiometer. The input command is an angular displacement. The potentiometer converts the angular displacement into a voltage.

Similarly, the output angular displacement is converted to a voltage by the potentiometer

in the feedback path. The signal and power amplifiers boost the difference between the input and output voltages. This amplified actuating signal drives the plant. The system normally operates to drive the error to zero then the motor will not turn. Thus, the motor is driven only when the output and the input do not match. The greater the difference between the input and the output, the larger the motor input voltage, and the faster the motor will turn. If the gain is increased, then for a given actuating signal, the motor will be driven harder. However, the motor will still stop when the actuating signal reaches zero, that is, when the output matches the input. The difference in the response, however, will be in the transients. Since the motor is driven harder, it turns faster toward its final position. Also, because of the increased speed, increased momentum could cause the motor to overshoot the final value and be forced by the system to return to the commanded position. Thus, the possibility exists for a transient response that consists of damped oscillations about the steady-state value if the gain is high.









1. Use Matlab-Simulink to determine the transfer function of the system.
2. Determine the step response for five different values of K (including one instability conditions)
3. Determine the rising time, steady state time, over shoot, and steady state error under the stability conditions from the previous question.
4. Compute the stability region and verify your response by determining the step response for selected values in the different ranges.
5. Determine a state space representation of the system and verify the order of the state space.
6. Convert your state space representation into external representation.
7. Plot the root locus of the system.
8. Discuss the stability of the system using the root locus. And check with the results of your computation and the responses you determined in the previous questions.