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ABSTRACT

A control system, where the control loops are closed through a real-time network is known as a Networked Control System (NCS). Where the information signals are exchanged through the network among the system's components to control the plant/system located in remote areas. In this thesis basic concept of NCS is explained including components associated with the NCS.

A DC servomotor is designed to be used as a servo plant in the Networked Control System (NCS). Its fitness is investigated with the application of step input. The frequency response and the transient response of the servo plant also investigated and the system response is obtained in the stable range. Hence the system is fit for application with high accuracy. This model is further used with controller in Control Area Network (CAN) network environment for performance analysis of NCS.

In this work a comparative performance analysis of different types of controllers like PI, IP and fuzzy controllers have been done to control the servo plant motor. It is also proved that the overshot of the system response is reduced using IP controller in compression with PI controller. But the overshot of the system can be further reduced using the fuzzy controller besides obtaining a reduction in settling time also. Therefore, the fuzzy controller is found to be more suitable to control the servo plant.

Further investigation are carried out to address the challenges associated with the NCS like time-delay, packet loss and other network uncertainties, by which the system may become unstable. To analyze the performance of the networked control system and to overcome these challenges, a servo plant is designed using appropriate parametric values of the plant so that it becomes stable, using system identification Tool box in MATLAB/SIMULINK. A robust PID controller is designed and its robustness is analyzed in different planes with the selection of suitable parametric values to ensure the stability of the controller.

The performance of the NCS using designed servo plant and robust PID control are investigated within a single PC as well as using two PCs connected through the LAN. The performance of the servo plant with robust PID controller was stable without network within a single PC, but with the inclusion of the network the system becomes unstable due to time delay, packet loss and other uncertainties of the network. To make this networked system stable a smith predictor (compensator) is designed for delay compensation, and with this designed compensator the NCS system's performance further analyzed and found stable.