Automatic Control of a Gantry Crane System

Background

Cranes as one of the major equipments in industries, exists in most places - from domestic industries to naval yards to warehouses, as one example shown in Figure 1. In these places the productivity of the activities depends on how efficiently the cranes are managed. One of the challenging in the control of the cranes is to deal with swaying phenomenon introduced by the trolley motion. This swaying not only reduces the efficiency of the cranes, but also can cause safety problem in the complicated working environment.

Figure 1. A real-world crane system in the harbor

Figure 2. The AUE Crane system

Problem

In Spring 2004 Group 672 has obtained some preliminary simulation and test results after they built this physical laboratory system as shown in Figure 2. However, due to limited project time, there are still many open problems. For example, there is too large uncertainty (2 degrees) of the angular measuring system; the developed controller didn't fully reach the objective – minimizing the swing of the payload at the end of the movement; Some inconsistencies are observed between Matlab simulations and practical tests. Therefore, how to improve the performance of the current system becomes a very interesting investigation.

Objective

The objective of this project is to improve the control of current crane system, which can include:

- Hardware improvements: for example, improving the current measuring methods/instruments, lengthening the traveling frame, improving the pivot mechanism between the cart and the payload cable, etc;
- Control strategy improvements: for example, designing and implementing a velocity shaped control strategy based on the improved system.

Since this is a further project based on this system, better system performance are expected through this project.

More Information (can be available upon requirement)

- DE-6 Gourp 672 (Spring 2004) report: Control of the Crane Project 2004
- Materials for Velocity Shaped Control

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