Course audit

Motion control made easy

Day 4 Automatic tuning

Topics of discussion:

- Known model
- Unknown model
- Specific move

In the early days of motion control, selecting the parameters of a compensation filter was a time-consuming and laborious process. Today much of the task can be automated, depending on what's known about the system.

Suppose the system is fairly familiar in terms of its operation and transfer function, but some parameters, such as load inertia and amplifier gain, are unknown. Here, tuning begins with parameter identification. Once the model is known, the next step is to follow a design method that leads to the required compensation. This works well as long as the system matches the model. If the system has some backlash or resonance not accounted for, however, the results may be useless.

When the system model is not known, tuning naturally is more experimental. Here an automated procedure might include a search method using some sort of criterion to identify instability. By searching all possible values of the filter parameters, a computerized system can quickly determine the most appropriate compensation, achieving maximum bandwidth, while maintaining a high degree of stability.

In some cases, the tuning must be done along the move itself. This is common when a system performs a given move and must complete and settle it in a minimum amount of time. As an example, consider a point-to-point move over a specified distance, with a given amount of allowable error and settling time. Here, an automatic tuning search will adjust compensation filter parameters until the system meets the given requirements.

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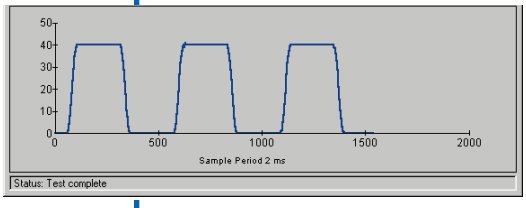
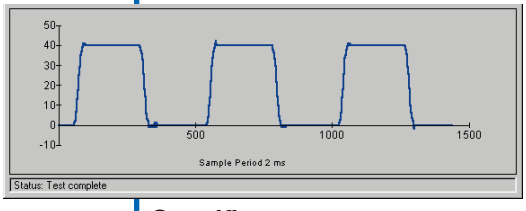
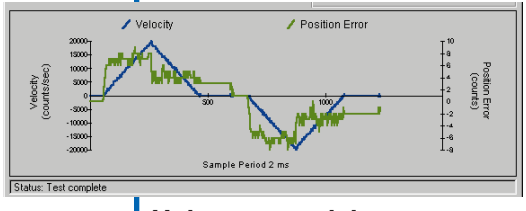
Tuning methods



Known model



Specific move



Unknown model

Examples of autotuning methods show how results vary depending on the amount of information available about the system. The top trace is what you can expect when tuning with a known model. The middle trace corresponds to the case of an unknown model, and the bottom trace to that of a specific type (point-to-point) of move.