Analysis and synthesis of real time high-order learning control with low pass filter

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Working machines in industries often operate repetitively and the basic control systems -P,PI, PID- are widespread. Feedback control with basic controllers will produce the same error level over and over in the repetitive tasks. One way to reduce this repetitive error in each cycle of the ultraprecision working machines can be achieved by using leaning control process.

Learning control (fig.1) applied to a repetitive task has the same desired trajectory in each cycle. The method using the error from last repetition to adjust the command in the current repetition is referred to general learning control. There are many physical systems that cannot operate with simple learning control. The use of low pass filter to cut off high frequency causing instabilities is shown to be very effective in general learning control.

It is also possible to account the error in the current repetition to the above controller before feeding into low pass filter. We refer this method as high order learning control. In this research, we have developed the stability
criterion for high order learning control with real time low pass filter. Because of using more information in learning process should gain more knowledge to eliminate the error in the next repetitive task. We are expecting to get a more robust controller and lower error level in this method.
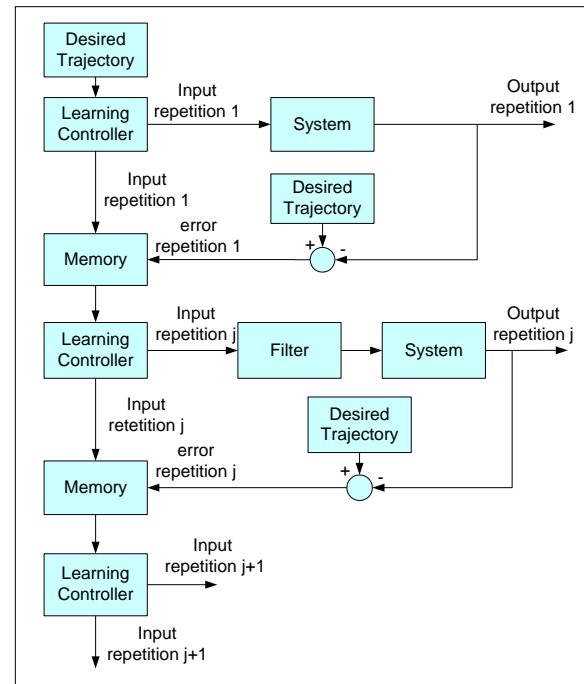

Figure 1 . Iterative Learning Control Flow Chart