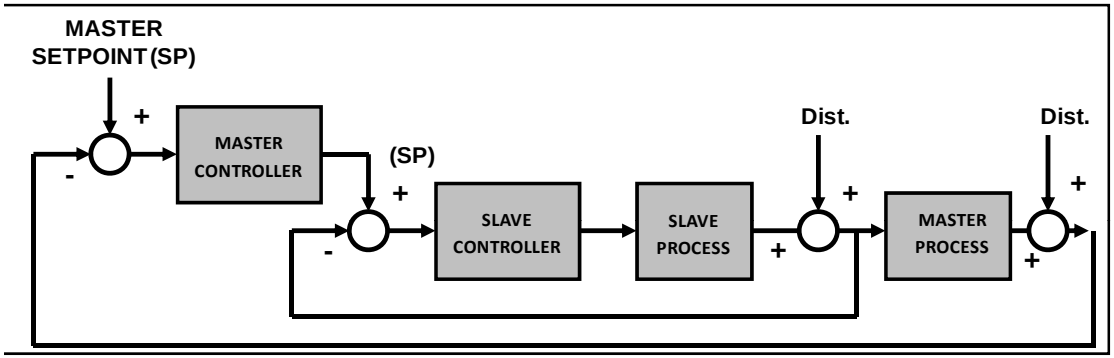
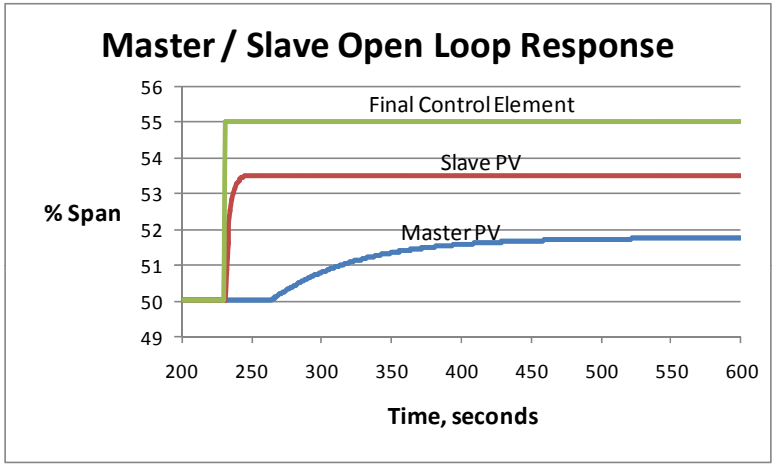
Opportunities for Cascade Control

How does it Work?

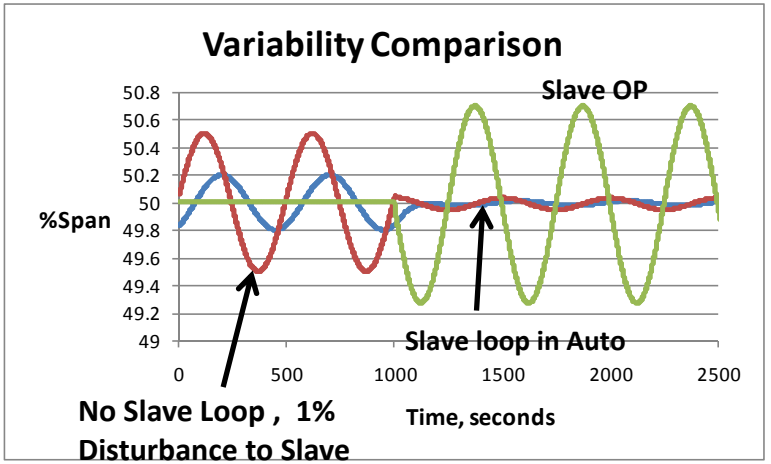
A cascade control strategy consists of a master loop and a slave loop. The slave controller receives a remote setpoint from the master controller. The slave controller drives the slave process to the remote setpoint. The master process responds to a change in the slave process.





Benefits

The primary benefit of cascade control results from the faster dynamics in the slave loop. The slave loop can be tuned aggressively, effectively shielding the master process from disturbances to the slave process. The Slave loop also protects the Master loop from control valve related non-linearity. The fast slave controller will work through backlash and stiction relatively quickly, minimizing the variability impact to the Master process. The impact of non-linear process gain resulting from control valve flow characteristics will be minimized since the Master controller is adjusting a setpoint rather than a valve position. Remember that an oversized control valve operating at a highly throttled position usually has higher levels of valve related non-linearity.



ProNamics Control Inc.

Opportunities for Cascade Control

Identifying Good Candidates for Cascade Control

Control loops that exhibit some or all of the following characteristics may be good candidates for a cascade control strategy.

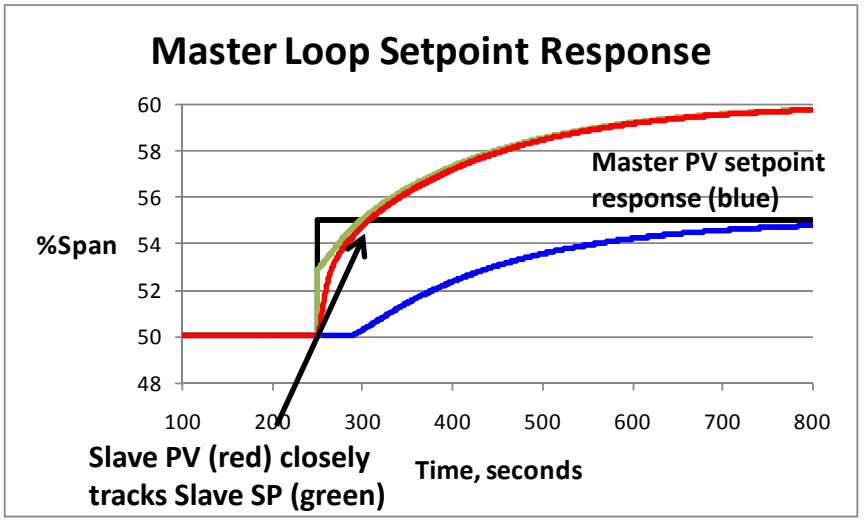
- The process dynamics are slow and contain deadtime. Even after optimizing the tuning, the controller is unable to attenuate the major external disturbances and the process variability targets are not being achieved.
- The closed loop dynamics of the proposed slave loop are fast enough to attenuate the major disturbances to the slave process. In addition, the slave process disturbances are a significant contributor to Master process variability.
- There are significant control valve related nonlinearities that are creating process cycles or compromising loop performance.

Typical Applications

- Level (master) to flow (slave).
- Concentration (master) to dilution flow (slave).
- Steam Header pressure (master) to air / fuel flow (slave)
- Temperature (master) to steam flow (slave)

Implementing the Strategy

- Ensure that the Slave controller tuning is fast enough to track the slave process to the remote setpoint.
- Install bumpless transfer logic so that the Master controller outputs tracks the slave loop PV when the slave controller is not in cascade mode.
- Make sure that the slave loop design is adequate to achieve the control objectives of the master loop. Typically, the slave loop PV span should match the 0 to 100% final control element range.



ProNamics Control Inc.