# High-precision and robust synchronization control with the UHC-126-U-ETC

If hydraulic axes are operated in NC mode, the position/speed control is carried out via the lag distance (dynamic position error). In these systems, a loop gain V0 is set and the lag distance (e) is proportional to the velocity (v).

$$e = v / V0$$

*UHC-126-U-ETC*

The loop gain V0 is the product of the controller gain and the system gain. Unfortunately, the system gain for hydraulic drives is not a constant value; it varies due to valve tolerances, external load forces and different speeds during retraction/ extension. This means that the lag distance varies in relation to the system gain.

In the case of a normal positioning drive, this is not a major problem. If, however, the drive is to be driven in accordance with other axes (path control or synchronization control), this leads to an unpredictable actual position of the axis. In synchronous control, different lag distances result in a synchronous error, which occurs if no additional control measures are taken.

In order to compensate for this error, an additional synchronization controller is required, which has different advantages and disadvantages depending on the concept. The biggest disadvantage is that if one axis does not behave as it should (e.g. oscillates), this is propagated to all other axes. It is often very difficult to determine which axis generates the problems.

But how would the performance improve if the errors caused by a changing system gain were eliminated in their cause?

It's very simple! If the loop gain is constant (resulting in the lag too), there will be no synchronization error.

This concept - MR controller for the linearization of hydraulic axes - was implemented in the UHC-126-U axis control modules and very successfully used in a press with four axes in synchronous operation.

**Summary of benefits:**

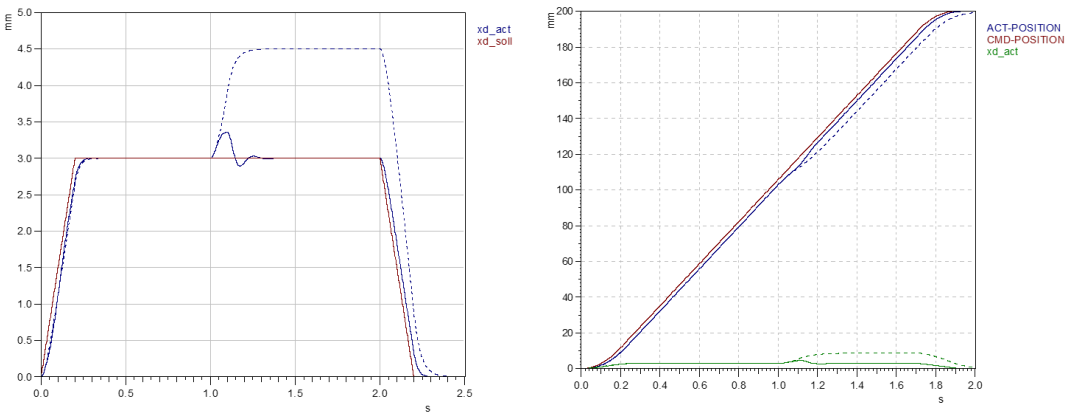
Linear behaviour of the individual axes (if the speed specification determines a lag distance of 2.5 mm, then it is in fact 2.5 mm)

Completely unrestricted activation, deactivation and movement of individual axes

No coupling of the individual axes via an additional synchronous controller, whereby many causes of problematic behaviour cannot arise anymore.

The synchronization no longer has to be controlled additionally, it only has to be monitored.

With this system, the synchronization error only depends on the speed of the fieldbus (signal transmission). If this is critical, our synchronisation control modules - with local communication structure - can be used which do not have any dead time generated by the fieldbus.




*Comparison of lag distance with and without MR controller. Without the MR controller, the lag distance increases from 3 mm to 4.5 mm (dotted line) due to the influence of an external force. MR control compensates for this.*

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