Burkhardt GmbH, Germany

With the Power of Two Servos

Burkhardt builds a 320 t servo-press with two torque motors, a motion controller, and safety control from Siemens.
Burkhardt GmbH in Bayreuth, Germany, has further developed its proven servo-press concept and transferred it successfully to a 320 t press. One of the major new features is two 500 kW 1FW3 torque motors that transfer their torque of 5,000 Nm each to the press ram through a distributor gearbox. This takes place following the tried and tested cam disc principle – that is, with optimized drive movements in all phases of the press stroke: highly dynamically in the idle stroke past the upper dead point, and in the operating range individually adapted to the respective tool and pressing. This enables up to 140 strokes per minute, is gentle on the press, and ensures long tool life, which the owner found to be a convincing argument for purchase.

Simple modularization by integration
With further development, the press manufacturer has geared his automation concept to the future and relocated the tasks previously implemented on a separate process control to the programmable logic control (PLC) section of the Simotion D445 motion control system.

The most powerful variant enables a reduction of the system cycle from the previous 2 to now 1 ms. It was and is therefore no great challenge to control additional drive axes and implement functions such as press force measurement, tool locking, or cam and feed control in the motion controller, entirely without time-consuming interface programming and adaptation. In this specific case, the drive of the feed unit, a converter of the modular Sinamics S120 series (AC/AC) with its own feed, is integrated. This allows the interaction of feed and ram movement to be matched very easily, flexibly, and harmoniously by electric cams. In addition, Simotion also controls the variable-speed standard Sinamics G120 (AC/AC) drives of the reel and straightening machine.

The integration also creates the conditions for simplified modularization of the automation. This allows programs to be created for complete press lines, including the reel, feed, and straightening unit, and for parts of it to be transferred to a low-cost single-axis D410 motion controller without any great engineering effort. The autarkically automated periphery from Burkhardt can therefore be integrated very easily into existing lines. The high computing performance also allows online calculation of

> Automatic generation of an individual cam disk for any tool based on relevant basic press data at the push of a button, only Simotion is capable of this at present.«

Stephan Seibel, Group Leader Electrical Design/Forming Technology, Burkhardt GmbH
Automated for Optimum Ram Control

To support the machine manufacturer and user, Siemens has developed SimoPress Servo, an application package for the total control of servo-presses with an integrated cam generator based on Simotion systems. With this, the press user can determine an energy- and process-optimized ram sequence very easily and individually for every tool and the corresponding transfer devices – that is, create ideal process conditions, all without any additional engineering effort or having to consult specialists from the press manufacturer or the control system/drive manufacturer.

Burkhardt has adapted the cam tool to its look and feel, which is familiar in the field, and has generated a simple input mask for the visualization under WinCC flexible. This mask contains input fields for the most important basic data of the forming process, including tool opening and closing angles, the position and stroke before and after the lower dead point, and the nominal stroke rate. From these few basic data, the Simotion system calculates the optimum ram kinematics for the tool within a split second at the push of a button, once at the initial setup and once after editing. The result is a motion profile with smoothly flowing transitions that are easy on the tool and material, that avoid excessive power and torque peaks, and that keep the drive power consistently within the necessary limits. The machine-specific maximum values defined in the drive design are automatically taken into consideration – for example, for motor speed, motor acceleration, jolt, motor power, ram speed, and acceleration, as well as the optimum forming speed.

This ensures that the permissible limits of the press and the powertrain are fully exploited but not exceeded. The field-weakening range of the 1FW3 torque motor is also exploited. These motors can be operated at reduced torque up to twice their nominal speed, which makes them ideal for dynamic ram movements outside the actual operating range.

Undefined distance or switching points can be moved with the electronic handwheel on the control panel and applied to the calculation at the push of a button, with optimized motion curves saved and read back in. This enables very easy and straightforward setup of new tools, and the production press can be used with minimum risk, also for the manufacture of production samples. The sequence of movements is always performed with optimized [timing, process, and energy consumption, which leads to much greater stroke rates in the lower dead point at equal or even reduced ram speed, with constant and in many cases even better forming quality.

Safety and energy efficiency

Burkhardt is also becoming more consistent in terms of safety technology. Safety functions are implemented on a fail-safe Simatic S7-300F (CPU S7-317F-2 PN/DP) and via distributed Simatic ET 200S I/O modules (with high-feature head module) via Profinet and the Profsafef protocol as well as with the use of integrated basic safety functions such as Safe Stop (SS1) and Safe Torque Off (STO) of the Sinamics S120 drive system on the main drives.

The servo concept already contributes to savings elsewhere: instead of the conventional flywheel, a practically maintenance-free capacitor package (nine capacitor batteries with a capacity of 132 mF each) buffers the braking energy in generator operation of the motors and provides it again in the operating stroke. In this way, both main motors can be supplied with a nominal power of 500 kW each via a single feed unit with just 80 kW. The energy buffer not only considerably reduces energy and operating costs but also simplifies the entire structure of the press and hence the maintenance and spare parts stocking.

Extended service possibilities

The now horizontally and vertically consistent automation concept also offers advantages in terms of service and maintenance. The Simatic Panel PC 677B not only allows local inspection but also insight right up to the drive level via Internet, which makes it easier to plan service assignments on-site or to dispense with them altogether. The manufacturer can support the owner remotely with troubleshooting in the event of any problems and can therefore reduce downtime. “The more automation components from Siemens we use, the more interesting the idea of a repair-service contract becomes,” Seibel says. This would allow Burkhardt to exploit the global presence of the world market leader and to contact expert personnel and/or procure spare parts quickly when required.