Servo-presses combine the high productivity of conventional presses with the flexibility of hydraulic aggregates

- Complete package for servo-presses

Productive and Flexible Presses

An integrated, individually applicable package solution for servo-presses brings together precise mechatronics design, intelligent motion control, powerful torque motors, and efficient energy management.
Deciding lot sizes, an increasing number of different products, and the need to manufacture these products cost-effectively are the great challenge in forming technology. An ideal solution is provided by servomotor-driven mechanical presses, which combine the productivity of conventional presses with the flexibility of hydraulic presses. What is required is that all the components of the drive train be carefully tailored to the mechanics and kinematics of the respective press design.

A universally applicable solution for servo-presses from Siemens makes this possible. The consistent hardware basis is formed by the Simotion motion control system, the Sinamics S120 modular drive family, and 1FW3 complete torque motors. The PC-based Simotion variants or robust operator panels and industrial PCs from the Simatic line provide visualization and order management.

Optimized processing conditions

Upon request, Siemens provides support to the machine manufacturer in designing the drive systems of its presses. Using an algorithm integrated in Simotion, the user can calculate the optimal movement sequences of the press ram, creating tailored processing conditions for every die and formed part.

The Siemens Mechatronic Support service department first analyzed the mechatronics and kinematics of presses as well as the pressing process in regard to mechatronics. A team of specialists from a wide variety of fields converted the results into a mathematical model and from it generated a simulation tool for press design. This allows the entire drive train consisting of converter, servomotor, and gears to be safely dimensioned – that is, to be precisely tailored to the mechanics of the press and the specifications of the machine manufacturer.

The OACAMGEN (curve generator) software module for Simotion is an enhancement to the simulation tool. It allows individual, energy-optimized ram operation profiles to be calculated for any Simotion-controlled servo-presses and dies. OACAMGEN is a component of the SimoPress Servo application package for the overall control of a servo-press. SimoPress Servo also has an input screen that allows the motion control of the servo-press to be visualized under WinCC flexible.

From the key data of the forming process entered, Simotion calculates in seconds the energy-optimal ram kinematics for the die in use. The result is an operation profile with transitions that are smooth flowing and gentle to the die and material and that avoid excessive power and torque peaks. This reduces the drive power that needs to be installed. The machine-specific maximum values defined during the drive design (e.g., motor speed and acceleration, ram speed and acceleration, optimal forming speed) are taken into account in the curve calculation. This allows the permissible limits of the press and drive train to be maxed out but not exceeded. The field-weakening range of the torque motors is used systematically in the process. They can run at up to twice their rated speed at constant power.

If specific waypoints or switching points are not known, they can be moved using the electronic handwheel and applied in the calculation. This allows production presses to be used in test mode in order to set up a new die. Optimized operation curves can be saved to the system and read back in if needed. Thanks to the energy-optimized motion control, the number of strokes per minute at the same or reduced forming speed can be greatly increased with forming quality that is at least constant, but that in many cases is even better.

Banks of capacitors as energy stores

For servo-presses of the medium power class, banks of capacitors are advantageous as energy stores. They allow energy that is collected during braking to be relatively easily and cost-effectively stored in the intermediate circuit and released during forming or acceleration.

The capacitor banks consist of six modules with a capacity of 132 mF each – that is, almost 800 mF per cabinet. Users can couple up to three of these capacitor cabinets together and greatly increase the storage capacity of the intermediate circuit.

This energy management system reduces the load on the power supply. The connection power can thus be dimensioned and planned to be significantly lower from the outset. Where the energy requirement is higher, the user can still use a traditional flywheel as a kinetic energy store.

For the safety of personnel and machines, Siemens has a variety of proven solutions in its product line – from drive-integrated safety functions in the Sinamics converters (such as safe torque-off) to power-scalable, fail-safe Simatic S7 300F controllers.

Just a few entries instead of protracted engineering: the standard input screen of Simotion SimoPress Servo under WinCC flexible