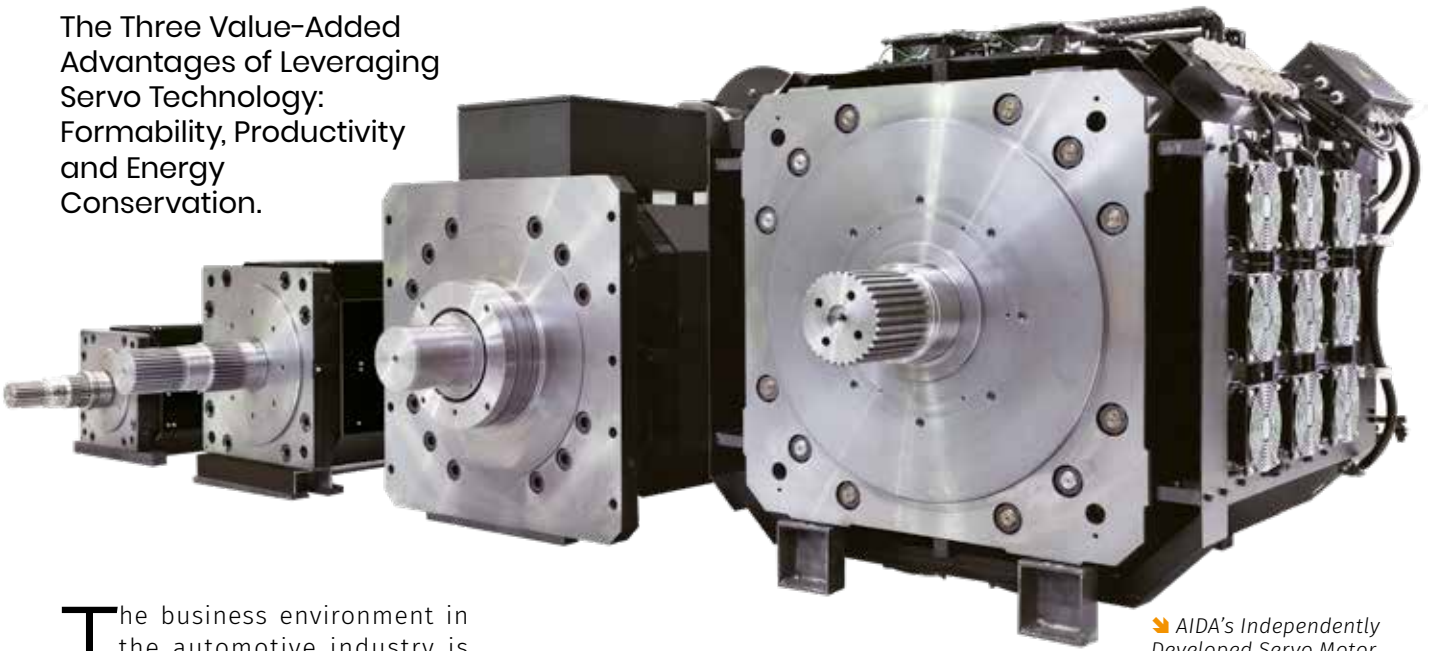
WHY DO AUTOMOTIVE MANUFACTURERS CHOOSE SERVO TECHNOLOGY?

The Three Value-Added Advantages of Leveraging Servo Technology: Formability, Productivity and Energy Conservation.



AIDA's Independently Developed Servo Motor

The business environment in the automotive industry is continuously evolving due to a wide array of factors, such as the rapid growth in newly developing countries and heightened environmental awareness. With the increasingly stiff competition, the determining factor for automotive manufacturers seeking dominance is the creation of body designs that attract consumers, lighter vehicles that boost mileage and stronger vehicles that enhance crash safety.

These trends are resulting in new challenges for the press industry. Increasingly sophisticated forming technologies are becoming necessary for both the forming of exterior panels for body designs and the forming of lighter and stronger frame members that reduce vehicle weight and improve crash safety. In response to the inability of conventional forming technologies to supply solutions to these problems, AIDA, the world's leading press-forming system builder, has created forming solutions by leveraging its proven capability to internally manufacture complete forming systems—including peripheral equipment—together with its independently developed technologies centred around servo presses. The value-added advantages provided by AIDA servo technologies can be expressed in three simple ideas: "Formability," "Productivity," and "Energy Conservation".

Enabling The Consistent Production Of Desired Shapes For Automobiles

In presses that are used to form automotive body parts and so on, a flat steel sheet is sandwiched between an upper and lower die and is "draw-formed" into the shape of a container. Achieving the breath-taking three-dimensional outer body panel designs that automotive manufacturers seek requires unprecedentedly high-level draw-forming technologies, and the only way to achieve this was to develop servo presses, where the forming speeds could be precisely controlled. In response to such requirements, AIDA independently developed a servo motor that could output high torque even at low speed, and the resulting servo press equipped with this motor enabled the draw-forming of highly designed parts that had previously been difficult to achieve.

In addition, performing simulations of the optimal forming conditions beforehand greatly reduces the time required for die

DSF-T4-30000 Press equipped with servo technology

adjustments and test forming, and even high-difficulty shapes can now be efficiently and stably produced. Moreover, utilising a simulation program makes it possible to realise identical product quality in all the production facilities around the world that have the same types of servo presses.

In the case of servo presses, the higher the press capacity is, the larger the servo motors and power supply capacity must be. AIDA decided to store energy in high-capacity capacitors aka condensers. Drawing power from the capacitors during the peak energy usage that occurs during the forming portion of the press stroke enables a lower-capacity primary-side factory power supply. Moreover, the electrical power that is regenerated when the press decelerates is stored in the capacitors and efficiently re-utilised, which helps contribute to lower energy consumption.

Real Case Scenarios Of Large Servo Transfer Presses

AIDA developed the 30,000 kN-class DSF-T Direct-Drive Servo Transfer Press Series to make the usually conflicting properties of material strength and press formability a reality in a cold-forming press. AIDA DSF T4 Series Large Servo Transfer Press is equipped with a wide forming area which has received high marks for the forming of large products such as automobile frame parts.

Achieving Both Optimal Forming and Higher Productivity

Due to the material properties such as high-tensile steel sheets and other difficult-to-form materials were prone to forming defects and product accuracy issues such as wrinkling and springback, when forming these materials in a mechanical press it was necessary to lower the operation speed to correspond to the product being formed, resulting in a production line that was about half that of a line forming conventional materials. On the other hand, AIDA's DSF-T Series presses can run at optimised speeds during each cycle.

For example:

- At the position where the material and the upper die come into contact, the speed can be slowed to a low speed of 100 mm/s or less to suppress impact-related vibration.

- Once forming begins, the draw-forming speed can be set to a constant velocity of 150 mm/s to assure that the material is being smoothly draw-formed and to prevent die galling.
- To assure sufficient time for the feeding of material, once the slide passes through the bottom dead centre the press can instantly shift to maximum speed until the slide reaches the material feed height, thereby enabling the running of the slide at optimised speeds during a single cycle.

The direct-drive design of the DSF-T Series incorporates a mechanical equalising architecture where the high-torque servo motors and all the gears are linked, and this simple design delivers superior maintainability. AIDA's independently developed high-torque servo motors exert a forming force of 1000 kJ (30,000 kN-class) even in the low-speed forming portion of the stroke, which is 1.5 times higher than a mechanical press.

With these functions, productivity when forming small panels from 30,000 kN-class high-tensile steel sheets has been boosted more than 1.5 times beyond conventional methods, thereby achieving both optimal forming and higher productivity for each product.

A System That Delivers Optimised Synchronisation with a Servo Transfer

For the servo transfer synchronisation system, AIDA has newly developed a PC-based synchronisation control methodology that automatically enables optimised phased operation for a wide range of slide motions. If there is sufficient clearance between the dies and fingers, it is possible to increase the line SPM by optimising the timing of each of the transfer motion ranges.

The PC-based controller developed for this optimised synchronisation system delivers the versatility and real-time performance of a PC along with the ability to exchange data with a wide variety of sensors, AIDA also developed an updated version of the AiCARE press information system that utilises the "Microsoft Azure" Windows cloud platform. When the press is equipped with AIDA's independently developed hydraulic servo die cushion that is perfectly synchronised with the slide motion, the motion is then servo-controlled from both above and below, which enables the further expansion of metal-forming thresholds.

AiCARE IoT System

IoT And Production Management Initiatives

AiCARE press IoT system architecture:

1 Forming Quality Information

This function is used to collect and analyse forming quality information during each press forming stroke, including load data, die deformation, motor vibration, and load torque. These information are collected for every stroke and saved in the cloud, and it is possible to view this on the AiCARE website as a 3D model. This also makes it easy to see forming load variations for specific dates and times.

2 Press Utilisation Information

The information gathered includes the production team name, the die number, the production quantity, the production time, the stop factors, and downtime as well as sensor-based press operational status information such as the temperatures of moving parts and power consumption. This information is collected on a regular basis and graphically displayed on the AiCARE website. Graphing the machine's operational status for specific periods of time enables the visualisation of stoppage details, occurrences, and trends. At the same time, it is possible to set a threshold value for each piece of collected data. If the collected data exceeds the threshold value, the system can send a warning email to the management personnel registered on the cloud.

3 Press Maintenance Information

Displays machine fault and error message histories to enable easy press maintenance support. Based on the press operating conditions, the system calculates the remaining service life of various components and the timing of inspections and sends out notifications. When the remaining service life falls below the warning threshold, the system can send a warning email to management personnel registered on the cloud.

The newly developed 35000 kN servo transfer press further leverages press utilisation Information and AIDA have developed a system that automatically writes daily work reports from the cloud to Excel, thereby eliminating customers' conventional handwritten daily reports. This enables the quick creation of error-free work reports and the timely outputting of accurate information. We expect these functions to also contribute to future work practice innovations. For more info, please log on to www.aida.com.sg