So, synchronous or asynchronous?

Thanks to the simplicity of its design, use and maintenance, its robustness and low cost, the asynchronous process is at present used very widely for motors within a power range from a few hundred watts to thousands of kilowatts. This technology is still successfully fitted on most Tornos products. Particular examples are the Sigma 32 machine recently released by the Moutier workshops, as well as the Gamma 20 whose two powered spindles comprise asynchronous motors. These motors are a big hit on the market. By way of example, the Sigma 32 spindles have met with much praise in the field, and provide astonishing power. So why has Tornos opted for synchronous technology? Interview with Dr Markus Thurneysen, Head of Design at Tornos SA.

**EVODECO 16:**
NEW TYPE OF DRIVE SYSTEM

Within a few weeks’ time the first customers will be working with the new EvoDECO 16. This machine was previewed at Simodec 2010, and it is now in the market introduction phase. With the EvoDECO 16, Tornos is inaugurating a new generation of powered spindles with synchronous drive systems. This innovation represents a clean break. Indeed, besides this new product, the vast majority of industrial applications are currently equipped with asynchronous drive systems.
decomagazine: Dr Thurneysen, why this revolution on EvoDECO 16?
Markus Thurneysen: It's not a technical revolution - synchronous technology has been used for many years on our multi-spindle lathes, but it is true that very few turning machines are equipped with this technology at the moment. To my knowledge, the EvoDECO 16 is the first sliding head lathe to be equipped with it. For us it is a strategic choice, Tornos is an innovative company that intends to stay at the cutting edge of technology in order to offer its customers efficient and competitive machining solutions.

dm: Is asynchronous technology no longer suitable?
MT: No, a great many motors operate with this straightforward and robust process: but synchronous technology is the technology of the future. Synchronous motor efficiency is more than 90%, whereas asynchronous motor efficiency barely exceeds 80%. Besides efficiency, the acceleration is also greater: going from 0 to 10,000 rpm takes 0.5 secs on a synchronous motor, as opposed to 2 secs on an equivalent asynchronous motor.

dm: What are the advantages for the customers?
MT: They get acceleration and stoppage times which are 4 times shorter, with a constant torque at all speed ranges. This means that depending on the parts, the cycle times can be greatly reduced. For instance, when many milling operations require frequent stoppages.

So synchronous motor technology can produce more parts per hour. This is demonstrated by the graph, which illustrates an acceleration test from 0 to 12,000 rpm between a synchronous motor and an equivalent asynchronous motor. A machining operation is run for 1.5 seconds at 12,000 rpm, and then we brake until stoppage. The asynchronous motor has just reached 12,000 rpm, whereas the synchronous motor has finished the operation and is already starting to brake. So the synchronous motor provides significant savings in cycle time, and therefore production gains.

Comparison of acceleration times between the two technologies
dm: The motors on the EvoDECO 16 machine are very powerful, (9.8/12 kW) for a 16 mm machine; so will it have a bigger current consumption?
MT: The EvoDECO 16 is a high-end machine with cutting-edge capability in terms of rigidity and machining power. We have to be careful with power figures; this spindle will not consume any more than another machine, quite the opposite. Since the synchronous motor has better efficiency, it will consume less energy for the same use.

dm: Besides its acceleration capacities, does the synchronous motor have other advantages for user customers?
MT: Yes, they get near-constant torque over its entire range of use. At 8000 rpm, the motor still provides its full milling force, whereas an asynchronous motor will only have 20% of its maximum torque at this same speed. So with softer materials such as brass, you can mill off an enormous amount of material, unthinkable with an asynchronous motor using high cutting speeds.

dm: In summary, does the synchronous motor provide only advantages?
MT: For the customer, yes. For us manufacturers, it is more compact and represents 20 to 30% less space requirement, but it requires de-fluxing (amplifier compensation for disturbing current created at high speed by induction of rotor field in the stator) in order to maximise torque at high speed, and its purchase price is twice as high.

dm: Why not extend it to the entire Tornos line?
MT: Because of their prices, Sigma and Gamma machines have to compete at levels where for the moment it is impossible to achieve the market prices with a synchronous drive system. When the Deco machines were released, synchronous technology was still limited to low speeds. Now it is price that is preventing its generalisation. The synchronous motor is intended for the moment for high-tech machines such as EvoDECO 16 or our multi-spindle lathes. In future we plan to expand our range of products using synchronous motors.

Comparison of synchronous and asynchronous motor torques