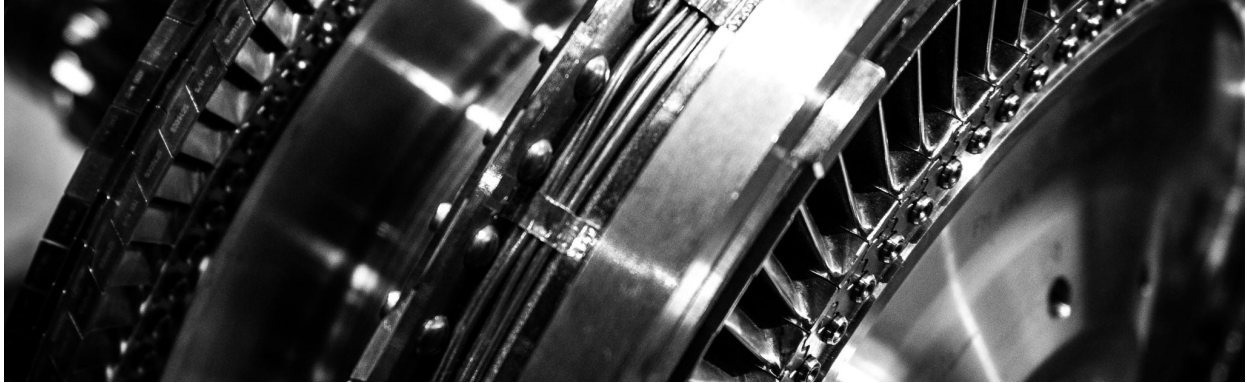


Sumitomo Drive Technologies

INDUSTRIAL GEARBOXES IN SERVO SYSTEMS

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Industrial Gearboxes in Servo Systems

Abstract

This whitepaper explores the numerous advantages of utilizing industrial gearboxes in servo systems. Industrial gearboxes play a crucial role in transmitting power and torque efficiently, reliably, and precisely. Cycloidal and hypoid gearing offer unique characteristics which make them highly suitable for demanding automation tasks. This paper aims to highlight why, and where, industrial gearboxes are a preferred choice for enhancing productivity, performance, and overall efficiency in automation processes.

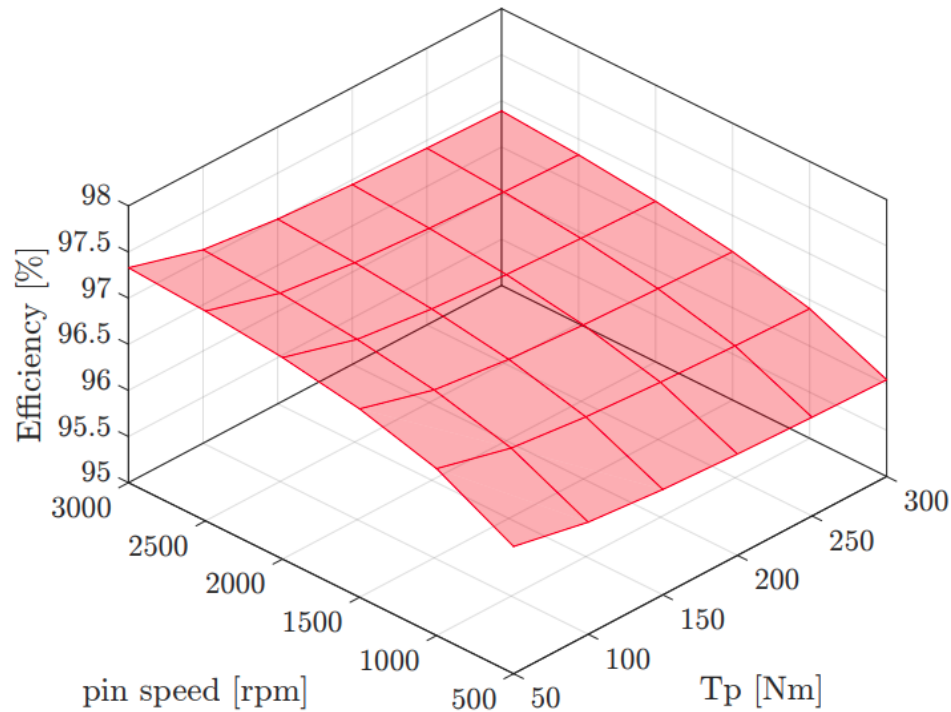
Torque

Designed and tested for maximum torque transmission, industrial gearboxes have been utilized in some of the most demanding applications for decades. This makes them ideal for challenging high torque and lower speed automation applications. Industrial gearboxes adapted for servo systems allow for more cost-effective motor solutions resulting in space savings and reduced power consumption.

Cycloidal gearboxes have a unique design offering multiple points of contact between the input and the output components. This results in distributed torque and reduced wear. These attributes make cycloidal gearboxes extremely torque dense. Hypoid gearing offers smooth and efficient torque transfer designed to minimize energy losses typically seen in worm gears. The larger contact areas and optimized gear tooth profiles enable automation systems to operate with higher torque transfer efficiency.

Efficiency

Industrial gearboxes are designed to achieve high power transmission efficiency. By utilizing precision-engineered gears, these gearboxes minimize energy losses during power transmission. Cycloidal gearboxes have the reputation of having highly efficient torque transmission. The unique “lobe” design instead of teeth allow for fewer losses, resulting in better distributed torque loads and reduced wear to the gearing. Hypoid gearing allows for right angle torque transmission of much higher efficiency than worm gears, with the capability of much higher ratios than bevel. The efficiencies change as the speed increases. In contrast, worm gear efficiencies vary with the ratio



Efficiency map as a function of pinion torque and pinion speed

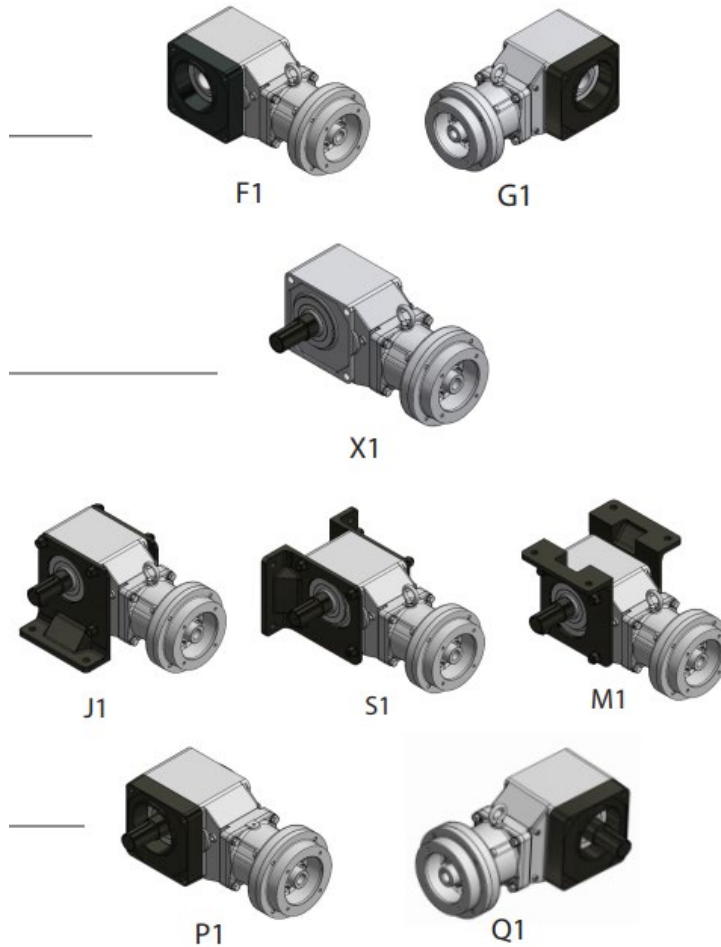
Citation: Grabovic, E.; Artoni, A.; Gabiccini, M.; Guiggiani, M.; Mattei, L.; Di Puccio, F.; Ciulli, E. Friction-Induced Efficiency Losses and Wear Evolution in Hypoid Gears. Machines 2022, 10, 748. <https://doi.org/10.3390/machines10090748>

Load Distribution and Shock Absorption

Industrial gearboxes, particularly cycloidal, excel in shock absorption capability. Cycloidal gear components are under compression, rather than shear stress found in involute profiles. The eccentric motion generated distributes the load across many lobes, minimizing stress concentration. This makes cycloidal gearing superior when absorbing shock loads and high inertia applications. Because industrial gearboxes are made for rugged applications and environments, they can be used as protective barriers between applications with sudden shock loads. This ensures smooth operation and prolongs the life of the machinery for automation applications.

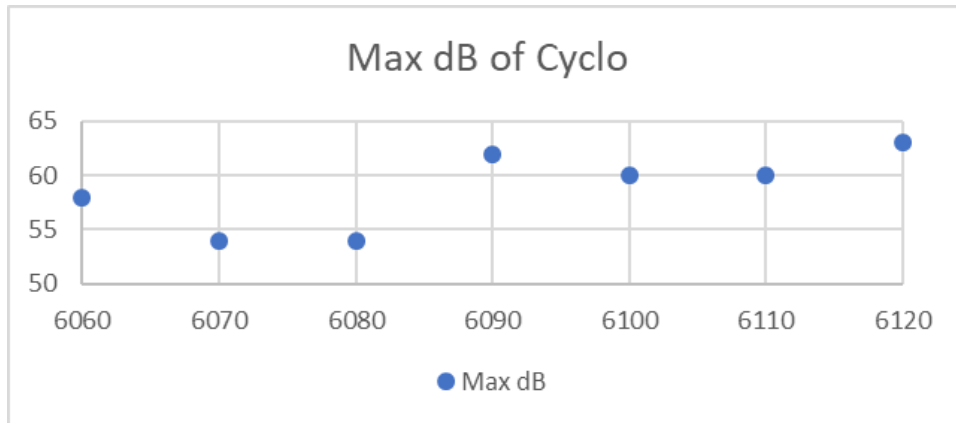
Versatility and Modularity

Industrial gearing comes in a wide variety of types, sizes, ratios, and optional configurations, making them highly versatile for automation applications. Inline or right-angled gearing allows for flexible integration into automation systems.



Noise and Vibration

Unwanted noise and vibrations can affect both machinery and human operators in automation systems. Cycloidal gearing is inherently quiet with a propensity to reduced vibration. The unique tooth engagement pattern of cycloidal gears reduces impact forces, resulting in quieter operation. This feature enhances workplace safety, minimizes operator fatigue, and reduces the need for additional vibration damping measures.



Caption: Maximum Noise of Sumitomo Servo Cyclo Units

Maintenance

Industrial gearboxes are designed with maintenance and serviceability in mind. Many gearboxes feature easily replaceable parts, simplified lubrication systems, and accessible inspection points. This ease of maintenance reduces downtime during scheduled maintenance or repairs, minimizing the impact on automation processes and maximizing overall equipment availability.

Hypoid and Cycloidal gearboxes are designed for longevity and require minimal maintenance. The combination of high-quality materials, advanced lubrication systems, and optimized gear designs results in gearboxes with extended service life. Reduced maintenance requirements contribute to increased uptime, improved productivity, and lower operating costs for automation systems.

Conclusion

Industrial gearboxes offer significant advantages in automation applications, enhancing power transmission efficiency, torque amplification, load distribution, precision, versatility, durability, and reducing noise and vibration levels. These advantages collectively contribute to improved productivity, reduced operating costs, and enhanced overall system performance. By leveraging the benefits of industrial gearboxes, industries can optimize automation processes, achieve higher levels of efficiency, and remain competitive in today's rapidly evolving industrial landscape.