

TECHNOLOGY SOLUTION

Mechanical and Fluid Systems

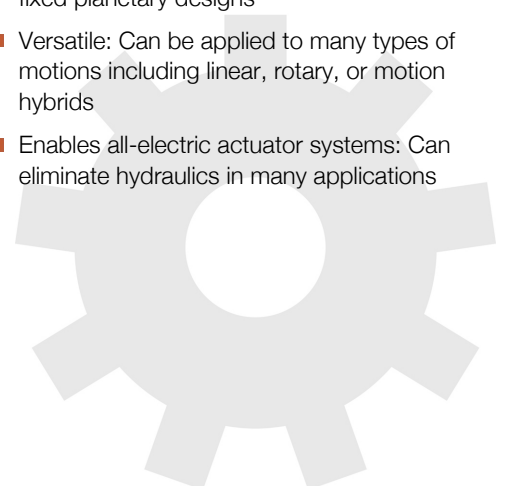
Gear Bearings

Increased capacity and performance with reduced size, weight, & cost

NASA Goddard Space Flight Center (GSFC) invites companies to license the revolutionary gear bearing technology. This technology represents a mechanical architecture breakthrough by combining gear and bearing functions into a single unit that significantly improves gear drives across the board for electrical, internal combustion, and turbine motors. The gear bearing design incorporates rifle-true anti-backlash, improved thrust bearing performance, and phase-tuning techniques for superior low-speed reduction. Because it combines gear and bearing functions, it reduces weight, number of parts, size, and cost, while also increasing load capacity and performance.

BENEFITS

- Precise control: Zero backlash results in smoother operation and superior control
- Improved thrust bearing: Gear teeth design gives superior thrust bearing performance
- Unprecedented speed reduction: Significant reduction ratios at both low and high speeds is achieved
- Less noise and vibration: More evenly distributed planet loading reduces cyclic loading and rough spots, reducing noise and vibration
- Fewer fatigue failures: Reduced cyclic loading decreases susceptibility to fatigue failures
- Low cost, simple design: Simplified design reduces materials, weight, and cost
- High strength: More structurally rigid and provide higher load capacity compared to fixed planetary designs
- Versatile: Can be applied to many types of motions including linear, rotary, or motion hybrids
- Enables all-electric actuator systems: Can eliminate hydraulics in many applications



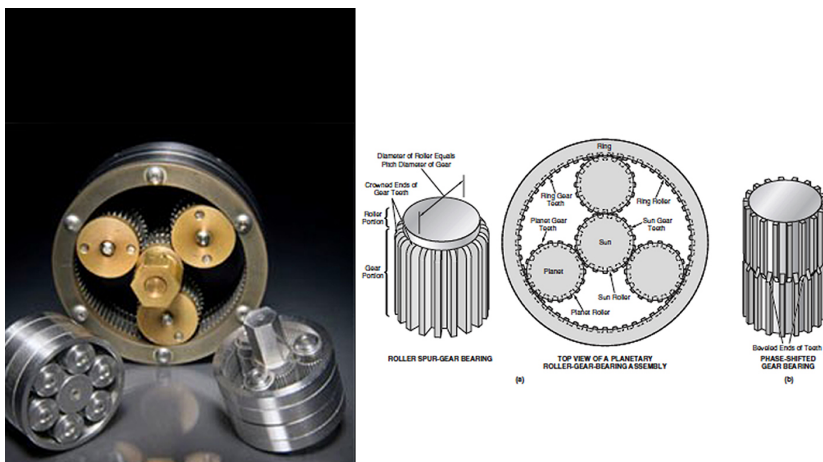
THE TECHNOLOGY

These patented gear bearings provide superior speed reduction in a small package. They form rolling friction systems that function both as gears and bearings and are compatible with most gear types, including spur, helical, elliptical, and bevel gears. These self-synchronized components can be in the form of planets, sun, rings, racks, and segments thereof. The design reduces micro chatter and eliminates rotational wobble to create smooth and precise control. It offers tighter mesh, more even gear loading, and reduced friction and wear.

Gear bearings eliminate separate bearings, inner races, and carriers, as well as intermediate members between gears and bearings. Load paths go directly from one gear bearing component to another and then to ground. By incorporating helical gear teeth forms (including herringbone), gear bearings provide outstanding thrust bearing performance. They also provide unprecedented high- and low-speed reduction through the incorporation of phase tuning. Phase tuning allows differentiation in the number of teeth that must be engaged between input and output rings in a planetary gearset, enabling successful reduction ratios of 2:1 to 2,000:1. They provide smooth and accurate control with rifle-true anti-backlash. This produces a planetary transmission with zero backlash. The gear bearing technology is based on two key concepts: the roller gear bearing and the phase-shifted gear bearing. All designs are capable of efficiently carrying large thrust loads.

Existing gear systems have drawbacks including weak structures, large size, and poor reliability, as well as high cost for some types (e.g., harmonic drives). Gear bearings solve these problems with simpler construction, fewer parts, and superior strength.

By selecting the appropriate manufacturing method and materials, gear bearings can be tailored to benefit any application, from toys to aircraft.



Photos (left) and line drawings (right) of gear bearings

APPLICATIONS

The technology has several potential applications:

- Transportation (including automotive, aircraft, marine, and rail): Transmissions, electric windows, windshield wipers, steering mechanisms, alternators/generators, engines and propellers, control systems, landing gear, door openers, rudders/ steering/leveling controls, winches, rail switching systems
- Power tools: Garden equipment, lawn mowers, chain saws, log splitters, power drills, car jacks, screw drivers, powered garage doors, powered winches, etc.
- Industrial machinery: Power presses, lathes and grinders, slitting and rolling equipment, construction equipment, lifting and handling equipment
- Farm equipment: Tractors, harvesters, hay rollers
- Toys: Electric robots, cars, and other motorized toys

PUBLICATIONS

Patent No: 9371855; 8,016,893

technology.nasa.gov

More Information
National Aeronautics and Space Administration
Agency Licensing Concierge
Goddard Space Flight Center
Code 102
Greenbelt, MD 20771
202-358-7432
Agency-Patent-Licensing@mail.nasa.gov
www.nasa.gov
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