

## 4.6 Gear Bearings

**Statement:** This technology represents a mechanical architecture innovation by combining gear and bearing functions into a single unit that significantly improves gear drives for electrical, internal combustion, and turbine motors.

**Problem:** There is a problem of having separate bearings, inner races, and carriers, as well as intermediate members between gears and bearings.

**Solution:** This technology combines gear and bearing functions into a single unit.

**Technology description:** The gear bearing design incorporates 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 of the product:** Gear bearings offer multiple benefits including:

- 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.

**Areas of application:** The technology has multiple 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, crew 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.