

## 4.2 Vibration Ring

**Statement:** Vibration ring reduces damaging and noisy vibrations within mechanical drivelines.

**Problem addressed:** Machine vibration often originates with rotating driveline components such as rotors, gears, bearings, and fans. Such vibration creates unwanted noise and can also be destructive to the machine.

**Solution:** Vibration ring provides damping within the driveline without disrupting the operation or position tolerance of the mechanical assembly. In addition to significant noise reduction, the ring also reduces overall wear and tear, and it can also generate electrical energy to power sensors on rotating machine parts.

**Technology description:** The ring-shaped mechanism reduces the effect of machine vibrations by converting applied vibratory energy into electricity. The mechanism is self-contained and requires no external wiring. Unlike traditional vibration-damping elements (e.g., those made of rubber), the vibration ring is very stiff, and can be used in a mechanical driveline without disruption. When this damping element is included within the driveline, vibration is attenuated before it manifests as noise elsewhere in the machine.

The vibration ring's compression cage is a ring-shaped mechanical amplifier. Forces imparted at any position around its perimeter are transferred into the axial direction. This transfer allows the use of a piezoelectric material, which is optimized to convert vibration energy along one axis into electricity. The generated electrical energy may be dissipated as heat or used to power system monitoring sensors. Whereas softer materials, such as rubber, tend to deform, the vibration ring attenuates vibration energy with very little deformation, making it appropriate for use within the driveline of a rotating machine. In addition, the vibration ring effectively serves as an energy sink, which can be placed near rotating vibration sources within a machine driveline. This prevents driveline vibration energy from exciting the rest of the machine and provides global noise reduction.

**Benefits of the product:** The vibration ring offers several benefits, including:

- Noise reduction: Attenuates vibration at its source before it manifests as noise and can be used to eliminate rotating machine noise, such as "gear whine".
- Power generation: Converts vibration into electricity that can be used to power other components, especially system's health monitors and sensors.
- Cost savings: Reduces driveline wear and tear, resulting in fewer repairs and less frequent replacement.
- Simple installation: Installs into the driveline as easily as a mechanical spacer.

**Areas of application:** The ring is designed to reduce vibration level and to generate enough energy to feed health monitoring system. It can be used in a wide array of applications, including:

- Ground and air vehicles.
- Agricultural and construction equipment.
- Drilling and cutting machines, mining.
- Generators, and wind energy turbines.