National Aeronautics and Space Administration

TECHNOLOGY SOLUTION

Mechanical and Fluid Systems

Fluid-Filled Frequency-Tunable Mass Damper

Includes an adjustable mechanism for altering frequency of mitigation

Innovators at the Marshall Space Flight Center (MSFC) have developed a fluids-based tunable mass damper system that allows for significant distribution of loads while also providing a simple mechanism that allows for the capability to change its frequency of mitigation with negligible impact on the damper system. For existing fluid filled pipes, ducts, ballast tanks, etc., the fluid can now be leveraged to provide vibration mitigation. This new technology enables structural engineers to set and change the fundamental mitigation attributes of the mass damper system with little to no modification of the fluid container.

BENEFITS

- Offers a simple compressible mechanism for changing mitigation frequency in a damping system that does not require a modification of the fluid tank geometry
- Enables small adjustments to frequency (+/- 10%) and large adjustments to frequency (2x - 3x) that can be done at will
- Minimizes size, weight, and cost in view of competing technologies
- Can be applied to numerous applications with different requirements for fundamental mitigation attributes
- Can utilize existing fluid filled reservoirs and or simple configurations of added reservoirs

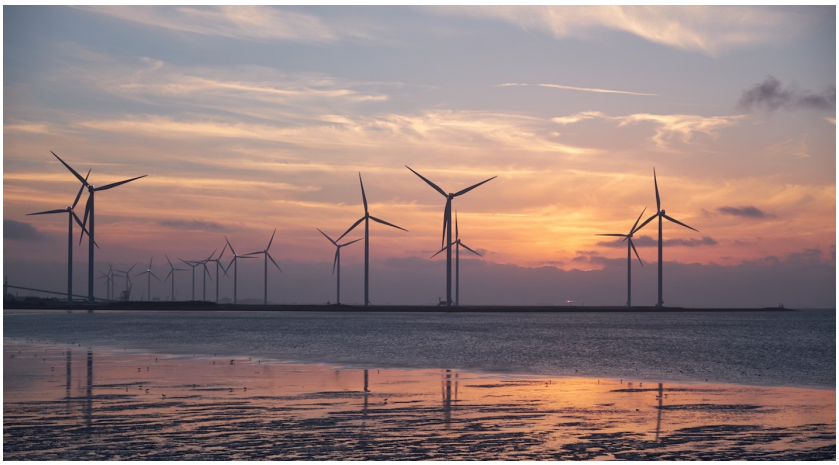
THE TECHNOLOGY

NASA MSFC's Fluid-Filled Frequency-Tunable Mass Damper (FTMD) technology implements a fluid-based mitigation system where the working mass is all or a portion of the fluid mass that is contained within the geometric configuration of either a channel, pipe, tube, duct and/or similar type structure. A compressible mechanism attached at one end of the geometric configuration structure enables minor adjustments that can produce large effects on the frequency and/or response attributes of the mitigation system.

Existing fluid-based technologies like Tuned Liquid Dampers (TLD) and Tuned Liquid Column Dampers (TLCD) rely upon the geometry of a container to establish mitigation frequency and internal fluid loss mechanisms to set the fundamental mitigation attributes. The FTMD offers an innovative replacement since the frequency of mitigation and mitigation attributes are established by the compressible mechanism at the end of the container. This allows for simple alterations of the compressible mechanism to make frequency adjustments with relative ease and quickness.

FTMDs were recently successfully installed on a building in Brooklyn, NYC as a replacement for a metallic TMD, and on a semi-submersible marine-based wind turbine in Maine.

The FTMD technology is available for non-exclusive licensing and partially-exclusive licensing (outside of building construction over 300 feet).



FTMD has been successfully incorporated into a semi-submersible wind turbine platform, and may be able to dampen potentially harmful shaking in a variety of other structures.

APPLICATIONS

The technology has several potential applications:

- Structural: Installations on large civil structures to mitigate flexing or bending modes (e.g., stacks, towers bridges, pools for spent nuclear fuel, etc.)
- Oil and gas: Offshore oil rigs, above-ground storage tanks
- Municipal: Water tanks/towers
- Marine: Installations on numerous maritime architectures such as submersible, semisubmersible and surface platforms to mitigate pitch, heave and/or roll
- Alternative to Tuned Liquid Dampers (TLD), Tuned Liquid Column Dampers (TLCD), Tuned Mass Absorbers, Tuned Mass Dampers (TMD), Harmonic Absorbers, or Seismic Dampers while providing enhanced packaging, performance and installation advantages

PUBLICATIONS

Patent No: 11,619,277

Rocket Technology Stops Shaking in Its Tracks.
https://spinoff.nasa.gov/Spinoff2017/ps_2.html

technology.nasa.gov

NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

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More Information

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