

Mechanical Technology

Advanced Magnetostrictive Regulator and Valve

Offering all-electric, highly accurate, low setpoint drift



NASA's Marshall Space Flight Center offers for license a set of unique magnetostrictive (MS) technologies. By combining MS-based sensors with a newly designed MS-based valve, NASA has developed an advanced MS regulator. This innovative approach provides both a regulator and a valve with rapid response times. In addition, the components are lightweight, compact, highly precise, and can operate over a wide range of temperatures and pressures.

Benefits

- **Lower Cost:** Reduces the number of valves used in typical regulated pressure systems
- **Fast Response:** Offers precise operation and control
- **Increased Reliability:** Uses fewer moving parts and no external or dynamic seals
- **Increased Redundancy:** Features a compact, lightweight design that allows alternate parallel pathways to be implemented without substantially increasing cost or weight
- **Self Adjusting:** Continuously senses and adjusts to ambient conditions to maintain precise control
- **Wide Applicability:** Capable of operating over a wide range of pressures, temperatures, and harsh environments



The Technology

How It Works

MS materials used in valves developed at NASA allow the valve to be opened and closed via application of a magnetic field to the outside of the valve envelope. This process contains all moving parts inside the pressure shell, eliminating the need for feedthroughs or mechanical seals. NASA's valve concept moves the valve coil outside a fluid boundary, keeping the coil from contacting the fluid under flow. This concept features a small valve design—no greater than 1/16 OD, and accommodates a digital design whereby multiple elements comprise larger flow needs, compensating for any insufficiencies when only one valve is used. This results in a highly effective, redundant valve system.

Building on this concept, NASA's MS regulator uses the MS valve element, an MS-based pressure transducer, and a servo-circuit to control the current to the valve coil. This all-electric design enables highly accurate and highly reactive regulation. As the current changes, the magnetic field strength adjusts, causing the valve poppet to reposition, bringing the pressure back to the setpoint.

Why It Is Better

Typical valves used in many applications suffer from leaks, failures, and are often considered too unreliable to be used in single-string systems. In contrast, NASA's approach using MS materials eliminates the issues of seal leakage, friction, and wear. In addition, using a small-scale valve in a large pressure plate enables multiple flow paths in a single flow duct, preventing contaminants from clogging the entire valve element. NASA's approach also uses fewer moving parts, offering greater reliability, safety, and longer life. The components are also at least one order of magnitude faster in response time in reacting to transients in supply pressure when compared to current control regulation methodologies.

Patents

NASA's Marshall Space Flight Center is seeking patent protection for the innovations involved in these technologies, and has received patent protection for the Magnetostrictive Valve Assembly (U.S. Patent No. 7,469,878).

Licensing & Partnering Opportunities

These technologies are part of NASA's Innovative Partnerships Program, which seeks to transfer technology into and out of NASA to benefit the space program and U.S. industry. NASA invites companies to inquire about the licensing possibilities for the Magnetostrictive Regulator and related technologies (MFS-32638-1, MFS-32253-1, and MFS-32614-1) for commercial applications.

Commercial Applications

- Pressure-fed rocket propulsion systems
- Aircraft engines
- Automotive fuel systems
- Manufacturing and Processing
 - Petrochemicals
 - Heated products (i.e., plastics)
 - Pharmaceuticals
- Machinery
 - Oil-flow control
 - Air and gas compressors
 - Steam turbines
 - Power recovery
 - Power-generating equipment
- Biomedical
 - Device implants requiring pressure/flow control
 - Drug metering systems

For More Information

If you would like more information about these technologies, please contact:

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