NASA Langley's Lightweight Low-Profile Transducer

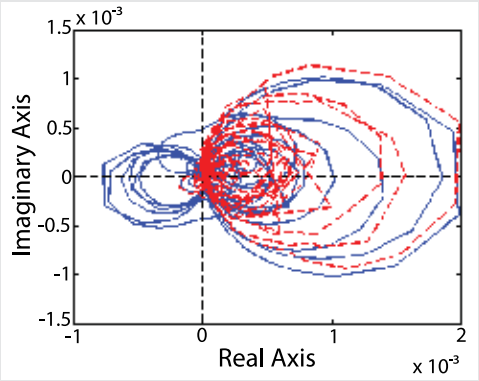
Capable of generating a transverse point load or measuring transverse velocity

Researchers at NASA's Langley Research Center have developed a novel transducer design capable of generating a transverse point load and measuring transverse velocity. The technology was developed to work in conjunction with an accelerometer to eliminate sound propagation through aerospace vehicles, specifically airplane and helicopter windows. Studies on aircraft acoustics have shown that the primary source of internal noise is external acoustic sources that propagate through the windows. Sources include turbulence against the fuselage, pressure variations, and the engines. The transducer works by generating a point source interference pattern along the edges of the window, thereby canceling out the ambient sound wave traveling through the window. The transducer can be readily incorporated into existing technologies for improved performance. NASA is seeking market insights on commercialization of the lightweight low-profile transducer, and welcomes interest from potential producers, users, and licensees.

Benefits

- Provides a lightweight and compact design
- Can be surface mounted or embedded
- Applies a point force
- Can act as a point source sensor

partnership opportunity



Nyquist plots of the open-loop frequency response function for the sensor-actuator transfer function from 2.5 Hz to 3 kHz using a traditional d31 actuator (solid blue line), and using the custom d11 actuator (dashed red line)

Applications

The device is ideally suited for any application that would benefit from the reduction of noise traveling through a material such as a glass window. Examples include:

- Commercial and military aircraft
  - Airplanes
  - Helicopters
- Industrial/manufacturing spaces
- Office buildings

Additional applications include:

- Acoustic speaker
- Point source sensor

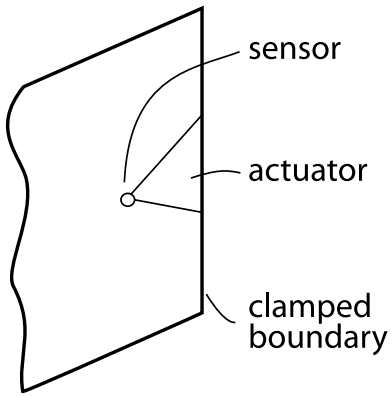
The Technology

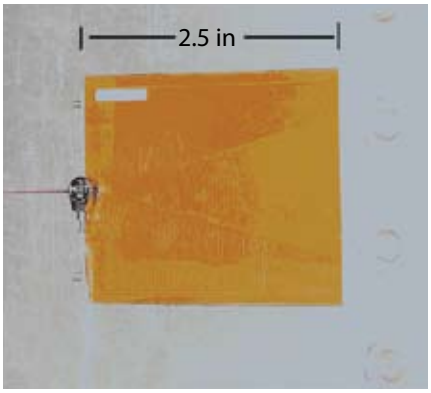
Acoustic disturbances in an airplane can be a major annoyance. Various techniques have been applied to successfully dampen noise produced by the engine or traveling through the fuselage. However, the windows have persisted in providing a pathway for the propagation of external noise into the vehicle.

Piezoelectric transducers have been developed that work in conjunction with an accelerometer in an attempt to cancel window noise. Accelerometers collect information as a point source whereas current transducers apply force over an area, resulting in reduced performance and efficacy as well as requiring the device to be positioned in the center of the window. NASA has solved these problems with the low-profile transducer, which incorporates a thin-layer, triangularly shaped piezoelectric material with interlaced integrated electrodes.

When used as a surface-mounted or embedded actuator, the integrated electrodes apply an electric field in a set planer direction. This produces a point source flexural response at the tip of the actuator. The point force created can be matched more precisely with the accelerometer readings, thereby producing improved sound cancellation capabilities. The design allows for a compact dissipative vibration control that can be embedded or mounted along the perimeter of the desired material.

The device can also be used as a transverse velocity sensor. When used as a sensor, the electrodes collect the electricity generated in the piezoelectric material. The charge output is proportional to the force applied at the tip of the device.





The diagrams show: (a) a triangular actuator and point sensor pair; and (b) a triangularly shaped actuator with an interdigitated electrode pattern mounted on a clamped aluminum plate.

For More Information

If your company is interested in licensing or joint development opportunities associated with this technology, or if you would like additional information on partnering with NASA, please contact:

The Technology Gateway

National Aeronautics and Space Administration

Langley Research Center
Mail Stop 218
Hampton, VA 23681
757.864.1178
LARC-DL-technologygateway@nasa.gov
technologygateway.nasa.gov

www.nasa.gov

LAR-17634-1

TOA 94
NP-2009-09-207-LaRC