National Aeronautics and Space Administration

Optics

Strobing to Mitigate Vibration for Display Legibility

Reducing the visual blur of an object being viewed by an observer experiencing vibration

NASA has developed an innovative method and apparatus for reducing the visual blur of an object being viewed by an observer experiencing vibration. This method mitigates the motion blur introduced when a display, and/or the operator reading it, is undergoing vibration (e.g., during the launch phase of spaceflight). If both the operator and the display are undergoing vibration, their respective impulses need not be in phase. This mitigation occurs when the display is illuminated at a strobing rate that corresponds with the frequency of the vibration. This can be done either by strobing the ambient illumination in the environment (e.g., if the operator is reading a reflective surface display), or by strobing the display itself (e.g., strobing the LED backlighting of an electronic display).

BENEFITS

- Allows clear viewing of a display in situations of significant vibration
- Allows perception in spite of the vibration
- Can work at lower frequency multipliers
- Cost and complexity of display mitigation is greatly reduced

technology solution

THE TECHNOLOGY

The dominant frequency of the vibration that requires mitigation can be known in advance, measured in real time, or predicted with simulation algorithms. That frequency (or a lower frequency multiplier) is then used to drive the strobing rate of the illumination source. For example, if the vibration frequency is 20 Hz, one could employ a strobe rate of 1, 2, 4, 5, 10, or 20 Hz, depending on which rate the operator finds the least intrusive. The strobed illumination source can be internal or external to the display. The strobe rate can be matched to the vibration frequency or to a lower-order multiplier of the frequency. Perceptual psychologists have long understood that strobed illumination can freeze moving objects in the visual field. This effect can be used for artistic effect or for technical applications. Current technical applications include: (1) strobing to maintain a rotating marker in a fixed position (e.g., the mark on an automobile timing belt appears stationary when properly tuned with the strobe rate of the timing light); (2) illuminating vibrating machinery with a light strobing at a rate matched to the vibration frequency to measure the frequency of a repetitive motion (vibration); and (3) illuminating vibrating machinery with a light strobing at a rate matched to the vibration frequency to allow inspection of the now visually stationary machinery.

Modern High-Speed Train

APPLICATIONS

The technology has several potential applications:

- Aerospace Industry
- Land vehicles
- Avionics Systems
- Industrial Machinery
- Naval Vessels

PUBLICATIONS

Patent No: 8,711,462

More Information

National Aeronautics and Space Administration

Technology Partnerships Office

Ames Research Center

MS 202A-3
Moffett Field, CA 94035
855-627-2249
ARC-TechTransfer@mail.nasa.gov

http://technology.nasa.gov/

www.nasa.gov

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