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Design and implementation of a gyroscope-free inertial measurement system

For fast moving vehicles, such as aircraft, spacecraft, and guided missiles, GPS-based navigation can be much too slow and inaccurate. In these situations, a navigation system based on accelerometers and gyroscopes can be used instead to provide accurate, real-time position and orientation data. Gimbal systems and gyroscopes are traditionally used to measure rates of turn, but these are bulky mechanical systems, prone to breakage, and are quite costly. We have built a system that uses only standard accelerometers to measure both the linear motion as well as rotational motion. The use of only accelerometers allows us to have a smaller, lighter, and less costly inertial measurement system. Using standard Secure Digital (SD) flash memory cards to provide long-term data storage, we have also created computer software to display and analyze collected inertia data.



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