



Energy Storage Flywheels on Spacecraft

Robert O. Barlett

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With advances in carbon composite material, magnetic bearings, microprocessors, and high-speed power switching devices, work has begun on a space qualifiable Energy Momentum Wheel (EMW). An EMW is a device that can be used on a satellite to store energy, like a chemical battery, and manage angular momentum, like a reaction wheel. These combined functions are achieved by the simultaneous and balanced operation of two or more energy storage flywheels. An energy storage flywheel typically consists of a carbon composite rotor driven by a brushless DC motor/generator. Each rotor has a relatively large angular moment of inertia and is suspended on magnetic bearings to minimize energy loss. The use of flywheel batteries on spacecraft will increase system efficiencies (mass and power), while reducing design-production time and life-cycle cost. This paper will present a discussion of flywheel battery design considerations and a simulation of spacecraft system performance utilizing four flywheel batteries to combine energy storage and momentum management for a typical LEO satellite. A proposed set of control laws and an engineering animation will also be presented. Once flight qualified and demonstrated, space flywheel batteries may alter the architecture of most medium and high-powered spacecraft.

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