

Gimbal Structure for the Design of 3D Flywheel System

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Abstract : New design of three dimensional (3D) flywheel system based on gimbal and gyro mechanics is proposed. The 3D flywheel device utilizes the rotational motion of three spherical shells and the conservation of angular momentum to achieve planar locomotion. Actuators mounted to the ring-shape frames are installed within the system to drive the spherical shells to rotate, for the purpose of steering and stabilization. Similar to the design of 2D flywheel system, it is expected that the spherical shells may function like a “flyball” to store and supply mechanical energy; additionally, in comparison with typical single-wheel and spherical robots, the 3D flywheel can be used for developing omnidirectional robotic systems with better mobility. The Lagrangian method is applied to derive the equation of motion of the 3D flywheel system, and simulation studies are presented to verify the proposed design.

Keywords : Gimbal, spherical robot, gyroscope, Lagrangian formulation, flyball

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