Inertial Sensing Hardware for Translational Drift Robots

Project Abstract

Team Members

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Project Description

Translational Drift is a classification of robot locomotion that makes use of the rapid spin of the robot to translate holonomicaly. With a single motor and wheel, the robot modulates the wheel torque at the same frequency as the rotational frequency, which results in translation of the robot in a direction dependent on the phase of the applied torque. This approach requires that the robot know two things about it's dynamics: the rotational position and velocity. A simple mems gyroscope is not suitable for the job, due to the high rotational rate of the robot and the significant gyroscopic and transient forces it experiences. I have successfully designed and built the robot's mechanical system in the past. I have made a few crude attempts in the past at the robot's inertial system which were functional but far from perfect. In the past I attempted to use a high-G accelerometer off axis, but it had no way to keep track of rotational positional other than by having the user orient it to "north" via remote control. This method proved functional but unsatisfying, as "north" would be subject to significant drift, requiring the user to keep reorienting it.

For my final project I would like to investigate the use of a hybrid system which would use a remote infrared LED beacon held by the user to resolve an absolute heading relative to the user, in addition to a pair of voltage sense taps on the brushless DC motor for estimating rotational velocity. The motor sense taps will be filtered and digitized to generate an encoder signal for the micro to read. This measurement will be used to pick up on the infrared beacon signal. The beacon will be strobing at around 1khz to avoid interference, and the robot will have a small ir photodiode pointing outwards to pick up the signal. I will design a filter to isolate the 1khz strobing, and use a PLL to lock onto the signal. The PLL will be disciplined by the motor velocity measurement so that it can lock easier.