

Pulsar navigation using Doppler Effect

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Autonomous technology in space navigation is a key to explore the solar system and beyond. Current space navigation technology requires constant communication between spacecraft and ground-based stations with typical error about 4 kilometres per astronomical unit. Pulsars are fast rotating neutron stars. Having high precision (in order of microsecond) in their spin period (approximately second to millisecond), they can be perfect tools for space navigation. As the observed pulsar's spin period changes with the relative motion between the spacecraft and the pulsar (i.e. Doppler Effect), we can determine the spacecraft's velocity in pulsar's direction. Using of three or more pulsars, complete velocity information can be determined. Proof-of-concept simulations with three fake pulsars have been done with C programming, which is shown to be consistent. The results indicate that the error strongly depends on the position of the three pulsars. For example, the maximum error occurs when the three pulsar are in the same position.

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