

Utilisation of the Dzhanibekov's Effect for the Possible Future Space Missions

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Vladimir Dzhanibekov is a famous Russian cosmonaut, who with his 5 space flights is recognised the champion in this category. During his fifth space flight, on 25-June-1985, he has discovered a spectacular (odd-looking or perceived by many as counter-intuitive and mysterious) phenomena, when a spinning rigid body in its stable flight suddenly changed its axial orientation by 180 degrees, simultaneously changing its direction of rotating to opposite in the body-axis coordinate system and continued its flight backwards. It was even more amazing for the discoverer to realize, that this pattern of motion has been repeated in the periodic sequence.

Afterwards, similar numerous experiments have been repeated on-board of the International Space Station.

This paper is uncovering the mystery of the interesting Dzhanibekov's Effect, providing systematic detailed explanation of the intriguing phenomenon using the numerical simulation methods and tools, employing non-linear equations of motion of the rigid bodies.

Based on the developed simulation model, we also explore the possibilities of utilisation of the Dzhanibekov's Effect for possible future new space missions, employing periodic change in the attitude orientation of the spacecraft. In our conceptual designs, in particular, we consider novel cases of the control of the dynamics of the spinning rotating spacecraft via active change of its inertial properties.