

Analytical Problems of Sailing in Space for Solar System Research

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We discussed shortly the development of analytical Solar Sailing theory applications to heliocentric transfer trajectories with the low thrust of light pressure from the Sun. This part of general problems of Cosmonautics and Celestial Mechanics connects with the name of russian pioneer of rocket motion theory in Soviet Union in 1920–1930 Friederich Arturovich Zander (1887–1933). He interested and developed not only rocket engine and construction principle but also Solar Sailing in space for the destination of Solar System planets – the so called heliocentric Sailing with reflecting space mirrors known as Solar Sails.

To 2026 three Solar Sailing research centrum exist in Russia: in Moscow (Keldysh Institute of Applied Mathematics of Academy of Science and some others organizations), in Saint Petersburg (mainly in St. Petersburg State University) and in Samara University of S. P. Korolev.

Structures of theoretical research are as follows: analytical laws of solar sail orientation relatively to solar radiation direction, optimal inclination of sail normal for the heliocentric transfer, optimal thrust parameters of sail, effects of degradation degree of sail material under the aggressive influence of solar wind corpuscular radiation, especially when the transfer goes toward the Sun, comparison with electrical engine power spacecrafts, ecological aspects of solar sailing (illumination of Arctic regions, shadowing by sail-shield against global warming of the Earth), space robots transportation under the shadow of sail surface and so on.

The demonstration of some sail projects, already realised successfully included, is proposed.

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