Mathematical modeling of the spacecraft motion in the Sun—Earth L_2 point vicinity

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This work covers ballistic design of the spacecraft transfer to the vicinity of the Sun—Earth system L_2 point and halo orbit motion in this area. The following methods and calculation algorithms are described: the algorithm building one impulse transfer trajectories starting at the LEO and ending at the halo orbit implying a swing by maneuver or not; the algorithm calculating the stationkeeping impulses, needed for the transfer to the halo orbit and for the long term halo orbit motion.

For calculation of one impulse flights from the Earth to the halo orbit (with the help of a swing by maneuver or without it) the initial approximation construction algorithm has been implemented. These approximations are calculated by means of two variables' function isolines construction and analysis. The transfer trajectory pericentre height above the Earth surface is considered to be such a function. The arguments of this function are the special parameters describing the halo orbit.

The described algorithm provides halo orbits with the given geometrical dimensions in the ecliptics plane and in plane orthogonal to it. The characteristic velocity costs needed for the stationkeeping have been evaluated. These methods were used for construction of the nominal orbits for the "Spectr-RG" and "Millimetron" spacecrafts.

Keywords: *halo orbits, L_2 point, isoline method, Spectrum-RG, Millimetron.*

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