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Note on the trapped motion in ER3BP at the vicinity of barycenter

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Abstract In this paper, we present a new approach for solving equations of motion for the *trapped motion* of the infinitesimal mass m in case of the elliptic restricted problem of three bodies (ER3BP) (primaries M_{Sun} and m_{planet} are rotating around their common centre of masses on *elliptic* orbit): a new type of the solving procedure is implemented here for solving equations of motion of the infinitesimal mass m in the vicinity of the barycenter of masses M_{Sun} and m_{planet}. Meanwhile, the system of equations of motion has been successfully explored with respect to the existence of analytical way for presentation of the approximated solution. As the main result, equations of motion are reduced to the system of three nonlinear ordinary differential equations: (1) equation for coordinate x is proved to be a kind of appropriate equation for the *forced oscillations* during a long-time period of *quasi-oscillations* (with a proper restriction to the mass m_{planet}), (2) equation for coordinate y reveals that motion is not stable with respect to this coordinate and condition $y \sim 0$ would be valid if only we choose zero initial conditions, and (3) equation for coordinate z is proved to be *Riccati* ODE of the first kind. Thus, infinitesimal mass m should escape from vicinity of common centre of masses M_{Sun} and m_{planet} as soon as the true anomaly f increases insofar. The main aim of the current research is to point out a clear formulation of solving algorithm or semi-analytical procedure with partial cases of solutions to the system of equations under consideration. Here, semi-analytical solution should be treated as numerical algorithm for a system of ordinary differential equations (ER3BP) with well-known code for solving to be presented in the final form.

Keywords Elliptic restricted three-body problem · Trapped motion · Riccati ODE

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