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Mercury's forced librations in longitude

M. Yseboodt

Royal Observatory of Belgium, Time, Earth Rotation and Space Geodesy, Bruxelles, Belgium (m.yseboodt@oma.be)

The planetary perturbations of the orbital motion of Mercury lead to forced librations in longitude (Peale et al 2007 and 2009, Dufey et al 2008). The main perturbations are mostly due to Jupiter and Venus, the main libration periods being 11.86 and 5.66 years. A numerical method can be used, by integrating a set of differential equations describing the librational motion of the mantle. Dissipation due to tides and core-mantle interactions is included. A resonance occurs with the free libration period and can amplify some planetary perturbations. The results are coherent with a simple analytical model that can predict the amplitudes and the phases of the forced long period librations. The link between the libration amplitudes and the moment of inertia ratio $(B - A)/C_m$ is also given.