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Poisson terms of the rotation of the non-rigid Earth at the second order

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The Poisson terms of the non-rigid Earth consist on the nutations of the angular momentum axis. When focusing in their pure quasiperiodic component, a part of each amplitude is due to the second order contributions that stem from mixing different first order functions. In particular, in this research we will consider the so called crossing-nutation effect. It is a consequence of the coupling among the first order nutations and the perturbing potential inducing them, what entails its non-linearity.

By means of a Hamiltonian approach, we work out this problem for a Poincaré Earth model by introducing an ad hoc non-singular set of canonical variables and employing Hori's method. The main conclusions are that: (1) the Poisson terms are affected by the internal structure of the Earth, in contrast to first order contributions; (2) the largest contributions are relevant at the microarcsecond (μas) order, the amplifications with respect to the rigid case appearing at different frequencies from those of the first order Oppolzer terms.

This work shows the unsuitability of current IAU nutation theory to tackle this kind of non-linear second order contributions, mainly because that theory is intrinsically linear.