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Zero initial partial derivatives of satellite orbits with respect to force parameters nullify the mathematical basis of the numerical integration method for the determination of standard gravity models from space geodetic measurements

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Satellite orbits have been routinely used to produce models of the Earth's gravity field. The numerical integration method is most widely used by almost all major institutions to determine standard gravity models from space geodetic measurements. As a basic component of the method, the partial derivatives of a satellite orbit with respect to the force parameters to be determined, namely, the unknown harmonic coefficients of the gravitational model, have been first computed by setting the initial values of partial derivatives to zero. In this talk, we first design some simple mathematical examples to show that setting the initial values of partial derivatives to zero is generally erroneous mathematically. We then prove that it is prohibited physically. In other words, setting the initial values of partial derivatives to zero violates the physics of motion of celestial bodies. To conclude, the numerical integration method, as is widely used today by major institutions to produce standard satellite gravity models, is simply incorrect mathematically. As a direct consequence, further work is required to confirm whether the numerical integration method can still be used as a mathematical foundation to produce standard satellite gravity models. More details can be found in Xu (2009, Sci China Ser D-Earth Sci, 52, 562-566).