# LAGEOS and LARES satellites attitude determination with the LASSOS spin model

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The equations of motion of an Earth satellite are usually written for its center of mass (COM), as the point ideally in free fall in the external gravitational field. However, the range measurements performed by the on-ground laser-ranging stations refer to a different point, close to the satellite surface and depending on the laser-system detector. Consequently, it is necessary to refer this "reflecting-point" to the COM by means of the so-called range-correction. In this regard, a key point is represented by the knowledge of the orientation of the satellite with respect to the inertial space. A refined knowledge for the spin evolution is also important for the improvements that can be achieved in modeling tiny non-gravitational perturbations: as for thermal thrust perturbations and a possible asymmetric reflectivity of the hemispheres of LAGEOS satellites. The better the models for the orbit perturbations, the better the precise orbit determination and, consequently, the better will be the measurements of the geophysical parameters of interest. Indeed, improved models for the perturbations together with an improved knowledge of the COM of geodetic satellites are very important issues for a refined definition of the International Terrestrial Reference Frame and for the measurements of the geocenter variations. Finally, the knowledge of the spin vector represents a key factor for time transfer experiments and for general relativity measurements with passive satellites.

We present the spin model LASSOS (LArase Satellites Spin mOdel Solutions) that we have developed to understand the rotational dynamics of the two LAGEOS satellites and of the LARES one. This model is general, not restricted to the fast rotation regime, as in the case of previous models, and it is based on the solution of the full set of Euler equations. The results related to the main thermal thrust perturbations will also be presented.