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Non-gravitational perturbations in NEODyS.

The case of asteroid (410777) 2009 FD.

Federica Spoto⁽¹⁾, Andrea Milani⁽²⁾, Davide Farnocchia⁽³⁾, Fabrizio Bernardi⁽¹⁾

⁽¹⁾*Space Dynamics Services S.r.l., Via Mario Giuntini 64, 56023 Navacchio di Cascina (PI), Italy,*

⁽²⁾*University of Pisa, Largo Bruno Pontecorvo 5, 56127 Pisa, Italy*

⁽³⁾*Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Dr., Pasadena, CA 91109*

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ABSTRACT

For more than ten years both the University of Pisa¹ and the Jet Propulsion Laboratory (JPL)² have been operating impact monitoring systems. These online information systems continually and automatically update the list of asteroids that can impact our planet in the next 100 years. The attempt to extend the monitoring time span to a longer interval and to go beyond planetary scattering encounters is at the frontier of research on the theory of chaos, nongravitational perturbations, and new observation error models. Some special cases, as (99942) Apophis, (101955) Bennu, and (29075) 1950 DA have been successfully handled. In all these cases the authors modeled and solved for parameters appearing in the non-gravitational perturbations, especially the Yarkovsky effect.

The presence of these cases for which non-gravitational perturbations are relevant in the orbit determination and in the impact monitoring, led us to develop a new, experimental software, namely OrbFit4.3. All the orbit determination process has to be done with seven parameters. The new software version 4.3 also implements a full seven-dimensional LOV and a seven-dimensional impact monitoring. We will show new features we added to NEODyS, which can handle orbits with more than 6 parameters.

¹ <http://newton.dm.unipi.it/neodys2/> since 1999, operated by SpaceDyS from 2011.
² <http://neo.jpl.nasa.gov/risk/> since 2002.

As an example, we propose to analyze the case of the asteroid (410777) 2009 FD, which recently appeared as a new special case. 2009 FD currently is the asteroid with the highest value of the Palermo Scale in the risk list with an impact probability of 2.7×10^{-3} .
