Rossi, Alessandro; **Valsecchi, G. B.**

Collision risk against space debris in Earth orbits. (English) Zbl 1219.70035

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Summary: Öpik's formulae for the probability of collision are applied to the analysis of the collision risk against space debris in Low-Earth Orbit (LEO) and Medium Earth Orbit. The simple analytical formulation of Öpik's theory makes it applicable to complex dynamical systems, such as the interaction of the ISS with the whole debris population in LEO The effect of a fragmentation within a multiplane constellation can also be addressed. The analysis of the evolution of the collision risk in Earth orbit shows the need of effective mitigation measures to limit the growth of the collision risk and of the fragmentation debris in the next century.

MSC:

70F15 Celestial mechanics

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Software:

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References:

[1] Alby, F., Lansard, E., Michal, T.: Collision of Cerise with space debris. In: Proceedings of the European Conference on Space Debris. Proceedings ESA SP-393, pp. 589–594. Noordwijk, Netherlands (1997)

[2] Chao C.C., Gick R.A. (2004). Long-term evolution of navigation satellite orbits: GPS/GLONASS/GALILEO. Adv. Space Res. 34:1221–1226 · doi:10.1016/j.asr.2003.01.021

[3] Cordelli A., Farinella P., Rossi A. (1998). The influence of the fragmentation threshold on the long-term evolution of the orbital debris population. Planet. Space. Sci. 46:691–699 · doi:10.1016/S0032-0633(97)00217-1

[4] Foster, J.L., Jr.: The analytic basis for debris avoidance operations for the International Space Station. In: Proceedings of the Third European Conference on Space Debris. Proceedings ESA SP-473, pp. 441–445. Noordwijk, Netherlands (2001)

[5] Öpik E.J. (1976). Interplanetary Encounters. Elsevier, New York, USA

[6] Rossi A., Farinella P. (1992). Collision rates and impact velocities for bodies in low Earth orbit. ESA J. 16:339–348

[7] Rossi A., Cordelli A., Farinella P., Anselmo L. (1994). Collisional evolution of the Earth's orbital debris cloud. J. Geophys. Res. 99(E11):23195–23210 · doi:10.1029/94JE02320

[8] Rossi A., Anselmo L., Cordelli A., Farinella P., Pardini C. (1998). Modelling the evolution of the space debris population. Planet. Space Sci. 46:1583–1596 · doi:10.1016/S0032-0633(98)00070-1

[9] Rossi A., Valsecchi G.B., Farinella P. (1999). Risk of collision for constellation satellites. Nature 399:743–744 · doi:10.1038/21565

[10] Rossi, A., Valsecchi, G.B.: Self generated debris hazard for satellite constellations. In: Second International Workshop on : Satellite Constellations and Formation flying. Haifa, Israel. February 19–20, 2001

[11] Rossi A., Valsecchi G.B., Perozzi E. (2004). Risk of collision for the navigation constellations: the case of the forthcoming Galileo. J. Astron. Sci. 52:455–474

[12] Valsecchi G.B., Rossi A., Farinella P. (2000). Visualizing impact probabilities of space debris. Space Debris 1(2):143–158 · doi:10.1023/A:1026568809585

[13] Valsecchi G.B., Rossi A. (2002). Analysis of the space debris impact risk on the International Space Station. Celest. Mech. Dyn. Astron 83:63–76 · Zbl 1010.70522 · doi:10.1023/A:1020174528386

[14] Valsecchi G.B., Farinella P., Rossi A. (2003). Collision risk: a new method for assessing and visualizing it. Acta Astron. 53:203–217

[15] Wetherill G.W. (1967). Collisions in the asteroid belt. J. Geophys. Res. 72:2429–2444 · doi:10.1029/JZ072i009p02429

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