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SPACECRAFT PLASMA INTERACTIONS: THE OPEN SOURCE SPIS CODE AFTER TEN YEARS OF DEVELOPMENT

Abstract

The interaction of natural or artificial plasmas with space vehicles can be harmful, in particular through surface charging and the onset of electrostatic discharges (ESD). Many different types of missions, systems and actors are thus in need of an assessment of these interactions. For such system level effects the numerical approach is often favoured. In this context, the absence of available simulation code led Europe to launch the development of the SPIS code (Spacecraft Plasma Interaction Software), mostly under ESA sponsorship. The main developers were Onera (solvers) and Artenum (framework), with also some smaller contributors in the collaborative context of this open source object oriented code.

After ten years of development (2002-2012) the code is now used for modelling a wide range of situations: different types of space missions (scientific, telecom GEO...), ground plasma tanks or experiments, specific devices (electric propulsion, neutralisers...) or effects (ESD onset)..., and even the extension to deep dielectric charging. Some specific features needed for some of these applications are still under development.

This paper will review the status of the code, including the various developments and application or validation cases. Recent original results in some of the application fields will be added to the review.