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Abstract

The formation-flying synthetic aperture radar (FF-SAR) concept has been introduced in the last decades to enable new operational modes exploiting a set of compact and low-weight satellite platforms carrying receiving-only SAR antennas that simultaneously collect the signal emitted by a single spaceborne transmitter and scattered by the observed scene. FORCE is an industrial research project funded by the Italian Ministry for Scientific Research leaded by the University of Naples. It is conceived as a FF-SAR based on a close formation of N receivers, so that the coherent combination of the collected echoes can provide a Signal-to-Noise Ratio (SNR) up to N times the SNR of each individual receiver. Moreover, when more receivers are available, it is also possible to implement High-Resolution Wide-Swath (HRWS) techniques. FORCE is composed by a fleet of very compact bistatic receiving-only platforms that follows the transmitter at large distance (70-100 km), flying in a close formation (within 1 km) on a 410-km sun-synchronous orbit (97 inclination). Each platform is conceived with a modular architecture, i.e. as an assembly of CubeSat modules (up to 12). Hence, each subsystem is composed by one or more CubeSat modules and then these modules are assembled in a plug and play configuration to compose the overall platform. In this paper, both system and platform design will be described. Concerning system design, preliminary results on formation design and distributed payload performance will be reported focusing on two operating modes, namely SNR improvement and HRWS. The solution implemented for formation design exploits as much as possible the natural relative motion of the platforms in order to minimize the required V, that is provided by means of 2U hybrid micro-propulsion system. For 1-year demonstration mission the total required V is less than 7 m/s, with a 6-day maneuver frequency and a minimum V of about 6 cm/s. Concerning platform design, preliminary results on the development of the modules containing the deployable SAR antenna, the relative positioning and propulsion systems will be shown. The antenna is a 1-m mesh parabolic reflector that is deployed in orbit. In the folded configuration, antenna and deployment system are accommodated into a 3U module. The deployment is activated by a gas cartridge system which extracts the antenna hub. An additional pneumatic system is then activated to move away the feed from the antenna plane.