
Preface

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Biographical notes: Simone D'Amico is an Assistant Professor of Aeronautics and Astronautics at Stanford University, California, USA. He is the Founder and Director of the Stanford's Space Rendezvous Laboratory. He received his PhD in Aerospace Engineering from the Technical University of Delft (The Netherlands) and received his BS and MS degrees from Politecnico di Milano (Italy). He has been working as a Researcher at the German Aerospace Center (DLR) from 2003 to 2013 in the fields of space flight dynamics, autonomous satellite navigation and control, spacecraft formation-flying, and on-orbit servicing. He gave key contributions to the design, development, and operations of spacecraft formation-flying and rendezvous missions such as GRACE, TanDEM-X, and PRISMA for which he received several awards.

The 5th International Conference on Spacecraft Formation Flying Missions and Technologies (SFFMT) was organised on May 29–31, 2013 by the German Aerospace Centre (DLR) in Munich, Germany. Following a well established tradition of organisation by national and international space agencies, the conference acted as a forum for global experts on technologies and systems for spacecraft formation-flying and on-orbit-servicing. Scientists and engineers from more than 22 nations and tens of institutions worldwide discussed ideas and shared experience on the most recent achievements in the area of distributed space systems. More than 14 missions were included in the scientific programme, being then at various points of their life cycle, from the preliminary to the detailed design, from verification to mission operations.

This special issue of the *International Journal of Space Science and Engineering* is titled 'Spacecraft formation flying' and collects 19 articles based on the outcomes of the 5th SFFMT Conference. After a first scrutiny done by the members of conference's programme committee, the best papers underwent a double-blind review process according to the journal standards. The resulting selection of invited papers covers a broad range of topics which can be virtually grouped in three main areas, namely *new mission concepts*, *planned/operative missions*, and *technologies*.

The *new mission concepts* papers provide a comprehensive overview of the objectives and technologies proposed in the fields of precise inertial formation-flying and on-orbit servicing around low and geostationary earth orbits. Highlights include two astrometric missions newly proposed to ESA for the first exhaustive census of terrestrial/giant planet architecture in the habitable zone and beyond. In addition reusable small satellites carriers are analysed for multiple close-in satellite inspection and debris disposal sorties.

The *planned/operative missions* section addresses the design of the ESA Proba-3 mission, including system level, autonomous formation-flying, safe orbits, as well as collision avoidance aspects. More papers are devoted to the most recent flight results obtained from two formation-flying systems currently in-orbit – TanDEM-X and PRISMA. This section is closed by a comprehensive analysis of the CloudSat's return to the A-Train constellation after a severe battery anomaly.

Different navigation and control aspects are addressed in the *technologies* papers. The frontiers of GNSS navigation in high elliptical as well as in low earth orbit are explored, including new relative positioning opportunities offered by multi-constellation GNSS and the modernised signal structures. Studies on rendezvous and autonomous spacecraft capture using model predictive control are presented. Finally novel technologies for enabling Coulomb induced spacecraft attitude control and cluster flight of fractionated spacecraft are discussed.