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THE SGR-RESI – A SMALL SATELLITE INSTRUMENT FOR SENSING THE EARTH USING GNSS
SIGNALS

Abstract

Over the last year, SSTL, together with partners from The National Oceanographic Centre, the University of Bath and the Surrey Space Centre have been developing a new GNSS instrument, with funding from the CEOI. Global Navigation Satellite Systems (GNSS), which include both the GPS and Europe's fledgling Galileo systems, radiate signals at the Earth from orbit. Beyond the every day application of navigation, these signals can also contain information that is valuable to scientists interested in studying the Earth from space. Information about the Earth's atmosphere and Ionosphere can be derived using a technique known as GNSS Radio Occultation (GNSS-RO), whereby signals that pass through the Earth atmosphere are received by a small satellite orbiting in a Low Earth Orbit (roughly 400-800km) and then looking at the distortions on those signals. GNSS-RO is a technique that is already well established and current satellite missions are already providing valuable data to scientists around the world. GNSS Reflectometry, on the other hand, is a relatively new application and this technique seeks to derive information about the Earth by looking at GNSS signals that have been reflected off the Earth's surface and subsequently received by a satellite in low Earth orbit. In the process of reflecting, these signals are distorted by the reflecting surface and, through the use of inversion models, it is possible to subsequently derive information about that surface from the signals. The driving application for this development is the monitoring of the Earth's oceans and, in particular, information about ocean roughness and wind speeds could be derived. Reflections off land and ice have also been detected and potentially contain a wealth of useful information. The concept has been proved on an experiment flown on SSTL's UK-DMC mission, but more data from orbit is required to improve the models that will allow this technique to become a useful tool to scientists. At its heart, the GNSS-RSI is a highly versatile, multi-frequency GNSS navigation receiver. With the addition of multiple front-ends, reconfigurable DSP capabilities, a small data recorder and specialised antennas, the GNSS-RSI enables both Reflectometry and Radio Occultation applications. Building on SSTL's small satellite expertise and using state of the art technology, the instrument aims to provide a highly capable yet relatively compact and affordable way of studying the Earth from orbit.