Key Technologies (7)
Structures Modeling, Designing, and Testing (1)

Author: Prof. Otto Koudelka
Graz University of Technology (TU Graz), Austria, koudelka@tugraz.at

Dr. Manfred Wittig
European Space Agency (ESA), The Netherlands, manfred.wittig@wxs.nl

CUBESAT TECHNOLOGY FOR EXPLORATION MISSIONS

Abstract

The reliability and functionality of small satellites (CubeSats) has significantly increased over the years. An example is the BRITE (BRITE Target Explorer) asteroseismology mission, composed of five nanosatellites in a constellation. Designed for a mission duration of two years the spacecraft are operating very well after seven years in orbit, delivering high-quality science data. This makes CubeSat technology attractive for exploration missions, e.g. deploying a fleet of relatively low cost spacecraft for large-scale in-situ measurements.

In the framework of ESA's OPSSAT nanosatellite mission key technologies have been developed which are currently tested in space. A very powerful processor including a large Field Programmable Array (FPGA) for the control of experiments, data collection, high-speed data delivery to ground and on-board autonomy is the core of the OPSSAT spacecraft. It is directly connected to a software-defined radio (SDR) front-end for communications tasks. The SDR front-end, originally foreseen for receive-only purposes, is currently developed further as a high-speed transceiver which can be used in X- or Ka-band, depending on the chosen up/downconverters. The processor and the SDR front-end were successfully radiation-tested in the ESTEC Co60 chamber for total dose and the Paul-Scherrer-Institute for single-event upsets.

In this paper the design and functionalities of the board processor with FPGA and the SDR front-end are described and first experience of the performance in space are presented. Examples of the application of both systems in data collection, experiment control and as an inter-satellite link system in a constellation of CubeSats in the context of exploration missions are described.