EARTH OBSERVATION SYMPOSIUM (B1)
Poster Session (P)

Author: Mr. Giuseppe Capuano
TECHNO SYSTEM DEV., Italy

Dr. Maurizio De Nino
Italy
Mr. Mariano Severi
TECHNO SYSTEM DEV., Italy

HIGH DATA RATE IMAGE COMPRESSION HW PLATFORMS

Abstract

Although improvements in telecommunications systems have been considerable in latest years, nowadays available downlink data rates still does not satisfy bandwidth requirements of state-of-art electro-optical payloads on-board satellites. So, on-board data compression still represents a key technology for high performance, high resolution electro-optical instruments. This paper is dedicated to the presentation of the latest generation of flight and ground HW platforms that TSD has developed or is developing for high rate data compression on board different space platforms (Satellites, Capsules, ISS, Sounding Rockets). We present the results of RD activities carried out in the field of both image and hyperspectral data compression. In the former case, TSD has been part of the working group (primed by Astrium France under ESA contract) for the design, manufacturing and test of CWICOM, the first radiation-tolerant ASIC implementing lossless and lossy image compression algorithm according to CCSDS 122.0-B-1 standard. CWICOM provides image compression with pixel rate higher than 60 Mpixels with pixel depth of up to 16 bits, supporting push broom and frame based mode. TSD contributed to CWICOM HLD description and designed the relevant simulation testbench, the bit-accurate SW reference model and a validation and evaluation platform. Thanks to its abundant resources (including standard camera interface, SpaceWire communication port and reconfigurable FPGAs for user defined auxiliary functions), the platform can be used for ground demo to easily implement proof-of-concept engineering model and as a reference design for flight hardware. CWICOM design is consistent with the long term know-how developed by TSD along the years in the field of image compression for space applications; this includes FPGA-based complex, real-time, image compression, data transmission and on-board storage units already used on ISS, low eart orbit capsules, formation flying satellites and sounding rockets. In the field of hyperspectral data compression, under an ESA contract primed by Politecnico of Torino, TSD is currently moving forward with the design of a IP core for FPGA and/or ASIC implementation of a lossy compression algorithm that is being proposed for CCSDS standardization. FPGA implementation of a novel low-resources algorithm for lossless compression of hyperspectral data has been proposed as well, for the Italian PRISMA satellite, for which we already designed the board for scientific data acquisition and formatting before transmission to the on-board mass memory. Preliminary results point to the possibility to achieve data compression with sustained data rate higher than 1 Gbps in Actel radiation-tolerant Axcelerator FPGA.