SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)
Advanced Technologies (6)

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NEW TELEMETRY SYSTEM DESIGN FOR FUTURE NANOSATELLITE MISSIONS

Abstract

Nanosatellite missions are a cost-efficient way of accomplishing science and observation tasks in space in low Earth orbit. Due to the growth of task complexity and therefore the increase in data amounts efficient communication strategies are needed and the on-board communication design must be adapted accordingly. To overcome the shortages in power and bandwidth, the entire telemetry system used on future nanosatellites has to be improved. As the bandwidth in the lower frequency ranges (L-/S-band) is limited, the combination of modulation and coding schemes should be optimized to increase the signal-to-noise ratio.

This paper presents a new approach of improving the communication system design efficiently by analyzing and optimizing each element in the communication chain on-board a nanosatellite. Next to the communication architecture currently used on TUGSAT-1, the first Austrian satellite, the general telemetry system requirements for nanosatellites and their future use in constellations are described.

Based on the identified requirements a communication system design is presented. Emphasis is hereby put on the physical and data link layer. Non-linear effects of currently available power amplifiers are investigated and linearization methods are provided. Suitable modulation and coding schemes are described and their performances are analyzed. In particular performance efficient LDPC codes are investigated and its implementation in an FPGA is proposed.