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SPACE SYSTEMS SYMPOSIUM (D1)
Enabling Technologies for Space Systems (2)

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DESIGN, INTEGRATION AND TEST OF SPACEWIRE EQUIPMENT AND NETWORKS

Abstract

SpaceWire is a widely used spacecraft onboard data-handling network technology adopted by ESA, NASA, JAXA and the international space industry for many missions including GAIA, BepiColombo, James Webb Space Telescope, GOES-R, and Astro-H. SpaceWire connects together instruments, mass-memory, processors, downlink telemetry, and other on-board sub-systems. This paper introduces SpaceWire and considers the way in which SpaceWire units and networks are developed, tested and integrated in space missions. It explores the essential analysis, test and development equipment needed at each stage of spacecraft development to enable efficient and effective use of SpaceWire.

At the feasibility and laboratory prototyping stage it may be required to interface with a prototype instrument using SpaceWire. A SpaceWire interface board provides a test PC with SpaceWire capability for exercising and testing the SpaceWire unit under development. An API that allows test application code to be transferred between operating systems and interface boards enhances reusability of the test and development software. To experiment with the SpaceWire network itself, SpaceWire routers are required either as standalone units or embedded in interface boards. For debugging the SpaceWire hardware and software, a link analyser is required to check that a link is operating correctly, to inject errors, and to check application software is behaving as it should when sending and receiving SpaceWire packets. The link analyser can monitor, record, analyse and display information flowing on the SpaceWire link. For real-time emulation of high-speed SpaceWire units or those that have some tricky timing constraints that cannot be met readily with an interface card and real-time software, a hardware-based emulation unit is required, which should be easy to configure and control. This type of unit is ideal for instrument emulation when developing mass-memory units or data processing units. It enables real-time instrument emulations to be implemented rapidly, allowing effort to concentrate on the real design problem. When working with a complete network a SpaceWire multi-link recorder is required that can collect possibly hours of data from several links in a network for subsequent analysis and display. This can save substantial effort in tracking down problems that occur only rarely and those related to the network itself. During integration it is very useful and time-saving to be able to confirm that the equipment being integrated conforms to the SpaceWire standard. A conformance tested that automatically checks equipment against the standard is required.