VERIFICATION FOR SPACEWIRE ENCODING CIRCUIT USING THEOREM PROVING

Session: SpaceWire test and verification

Short Paper

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ABSTRACT

This paper is based on part of the job in the development of Space Solar Telescope (SST) project completed by National Astronomical Observatories, Chinese Academic of Sciences. For the requirement of building a highly reliable communication system, SpaceWire technique was applied in this project. In SpaceWire protocol, Data-Strobe (DS) encoding, which was an encoding scheme for transmitting data in digital circuits without a separated clock signal, facilitated the construction of high reliability communication on board. This study aimed to verify the implementation of the DS encoder circuit, which has to implement the asynchronous circuits in FPGA due to the separated clock signal, faithfully implemented the SpaceWire protocol, a formal verification method, theorem proving, was applied on this design. According to SpaceWire protocol, a primitive recursive function was defined using ML (Meta Language) in order to specify the circuit. Then the components implemented in

VHDL code were modelled with predicates. By using theorem proving in HOL tool, equivalence checking was applied between the specification and implementation. The result showed that the implementation equivalented to the specification and the asynchronous problem can be solved successfully. It suggested that this DS encoder circuit implemented on FPGA can be applied reliably in the SpaceWire which was developed in SST project.