論文の内容の要旨

論文題目 ： Study on Link-Bus Hybrid Information Network and Its Optimization for Small Satellites

(小型衛星におけるリンクーバス・ハイブリッド情報ネットワークとその最適化に関する研究)

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本文(Abstract)

In recent years, there has been considerable interest in the potential of small satellites. Because of the low cost and the short development time, small satellites have been considered for the device test, quick and small experiments on the orbit and the training of engineers. And recently, small satellites start to act as an alternative of big satellites from the progress of technology. Until this time, the major researches have been carried on the integrated architecture using the experience of big satellites. But, these days, distributed architecture is focused to reduce times and costs associated with the developments of small satellites. The main reason of this is the distributed structure is capable of module design.

The distributed architecture has many merits, but communication between these divided sub-systems occurs through explicit message passing. Therefore, the underlying interconnection network plays on important and direct role in determining their reliability and performance. Some designs use the high reliable data bus of military specification such as MIL-STD-1553. But this kind of data bus needs very high cost, and it is hard to construct complete distributed architecture because of the specified data bus controller. Because of these reasons, many designs use the commercial and industrial connections and provide the high reliability and performance from the redundant connections. Popular standards of connections are I2C, RS232, Ethernet, CAN. Recently, the Spacewire also has remarkable achievements from

its adaptability and performance.

From the time of computer network is introduced, many network topologies are proposed for the system network. But the module design of small satellite needs the conditions of regular structure, expandability, redundancy for the reliability, and the proper cost. Considering these conditions, the capable topologies are limited. And almost every topology used same kind of connection for the redundancy because of the simplicity. On the contrary of that, in this paper, a hybrid network topology using links and a data bus is proposed and studied the reliability and the performance. Hybrid network architectures employ two or more network technologies simultaneously. They aim at improving the overall network design by combining the advantages of different technologies while avoiding their disadvantages. The link and the data bus have completely different characteristics. And the main idea of the proposed hybrid network is synergy of the links and the data bus. After the evaluation, several methods are introduced to optimize the proposed network topology. First, a batch design algorithm is introduced to minimize the accumulated intermediate arrival rates. And several basic rules are proposed for the stable message control. After that, routing methods are proposed to find optimal path to transmit the message. Finally, fault tolerance is presented with the fault announce scheme.