

SYMPOSIUM ON VISIONS AND STRATEGIES FOR THE FAR FUTURE (D4)
Space Elevator Design and Impact (3)

Author: Dr. Zhaohui Dang
College of Aerospace Science and Engineering, National University of Defense Technology, China

Prof. Zhaokui Wang
School of Aerospace, Tsinghua University, China
Prof. Yulin Zhang
School of Aerospace, Tsinghua University, China

COMPARISON AND ANALYSIS OF CENTRALIZED AND DECENTRALIZED SCHEMES OF
NAVIGATION SHARING FOR SATELLITE CLUSTER**Abstract**

Navigation sharing means the transmitting, fusion, and sharing of the navigation data in a cluster of satellites. This concept is firstly mentioned by Owen Brown in 2006 and further researched by the current authors in 2012. Navigation sharing is extremely crucial for the normal flight and collision avoidance of the satellites that fly near to each other in space. However, navigation sharing as a new technology is still not pay enough attention.

There are two basic types of navigation sharing schemes, i.e. centralized scheme and decentralized scheme. The centralized scheme is also named as the server/client scheme. In this scheme, a satellite with a powerful computer and antenna is selected as the server, and other satellites are recognized as clients. The clients report their positions and attitudes to the server and receive the navigation data of other satellites from the server. The server can store all the navigation data in its memory and broadcast this information to any satellite.

The decentralized scheme is also called the distributed scheme. In this scheme, there is not any central node in the whole group. All the satellites in the group are equal with each other. To achieve the navigation sharing, each satellite will exchange its own navigation data with its neighbors. When the target satellite is in the interior of the sphere with a radius defined by the communication range of the source satellite, it is recognized as the neighbor of the source satellite.

There are both advantages and disadvantages in these two schemes. For the centralized scheme, when the range of the client relative to the server is too large, the transmitting of the navigation data between them cannot be achieved. Contrarily, in the decentralized scheme, any satellite has more possibilities to transmit its navigation data to others. However, the decentralized scheme also has shortages. For example, the global navigation sharing must rely on the heavily communication among the satellites.

Therefore, these two schemes are applied in different scenarios. When the group is small or there is a satellite with powerful computers, the centralized scheme is a good selection. However, when the group is too large, the decentralized scheme is more appropriate.

These two schemes are performed in a simulation system. The simulation results illustrate well the analysis of the above discussion.