

## Location estimation of the space electromagnetic environment monitor

Shintaro Kitagawa[1]; Yasuhisa Takizawa[2]; # Hirotsugu Kojima[1]; Yoshikatsu Ueda[3]; Hisato Iwai[4]; Hiroshi Yamakawa[1]

[1] RISH, Kyoto Univ.; [2] ATR; [3] RISH, Kyoto Univ; [4] Dept. of Engineering, Doshisha Univ.

The space electromagnetic environment monitor is designed to meet the objective of monitoring the artificial disturbance due to human activities in space at the multiple points of the target region. Since they are distributed spatially at random and move very slowly, we need to trace their moving and to know the precise location of each monitor. It is a kind of ad-hoc sensor networks. They will communicate with each other. However, the resource of the space electromagnetic environment monitor such as a weight and electric power is very limited, because they should be very compact about 15cm of the diameter. The highly-developed hardware onboard satellites for the location estimation cannot be expected. Generally, one can make use of the GPS system in order to estimate location on the ground. However, sometimes in space, we cannot make use of the GPS system. For example, when the monitors are distributed in higher orbits than those of the GPS, the location estimation of monitors should be done in other methods.

We examined several methods for the location estimation of the space electromagnetic environment monitor and selected the method proposed by Takizawa et al. [2005]. It is based on the Self-Organizing Map(SOM) algorithm. It is proposed for the ad-hoc network on the ground. However, it can be used in space, if we extend it to three-dimensional algorithm. The main feature of this method is to require only distance measurement among the neighborhood sensor nodes. The iteration for the difference between the own tentative location and the measured distance is conducted based on the distance measurement. This means the present SOM algorithm method does not require much resource for the location estimation of each monitor.

We extended the SOM algorithm method to the 3-dimensional one and examined the efficiency using the computer simulations. The results show the performance of the algorithm is good enough to be made use of in the location estimation of the space electromagnetic monitor system.

In the present paper, we introduce the 3-dimensional SOM algorithm method and discuss how we implement this method in the space electromagnetic environment monitor.