Evaluation of Antenna Beam Search Algorithm with Stop Condition in Frequency Sharing

Kizuku KAWAMURA[†], ***Student Member***, **Kohei AKIMOTO**[††], ***Member***, ***and*** **Osamu TAKYU**[†a)], ***Senior Member***

1. Introduction

Antenna beamforming is expected to suppress the range of radio emission and enable spatial frequency sharing [1]. Therefore, the authors proposed an algorithm to search and determine the beam, but it may require a huge amount of computation under certain conditions.

2. Proposed Beam Selection Algorithm

The proposed algorithm performs the search in three stages to narrow down the beam. However, as shown in the image of the algorithm in Fig1, if the final output solution has a large number of constituent beams, the number of beam patterns to be searched becomes huge and the computation time may exceed the time required for beam predetermination.

In particular, the computational load tends to be high due to the huge number of patterns in the third stage, which searches for a single beam. Therefore, if the output beams of the second stage have a high number of beams (more than 6 beams), the search is stopped and the beams at the output of the second stage are used for evaluation, otherwise the search is completed up to the third stage.

3. Algorithm Evaluation

The simulation data of propagation in Nagano and the terminal location information in October 2021 are used to evaluate the hourly beam search.

The Table1 shows a comparison of the number of beam calculations in the third stage without and with the stop condition. The total number of calculations in a month was 13311 without the condition and 7429 with the stop condition. The stop condition reduced the number of calculations by more than 40%.

According to the evaluation results in Table2, 90% of the terminal coverage is guaranteed for the algorithm setting, and there is almost no difference between with and without the stop condition. In contrast, the interference area is narrowed without the stop condition due to more effective beam selection, and the difference is 0.02km^2.

Although there is usually a trade-off between the number of pattern calculations and the interference area, the results show that the third stage condition stop significantly reduces the number of calculations for a decrease in interference, resulting in a more efficient beam search.

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References

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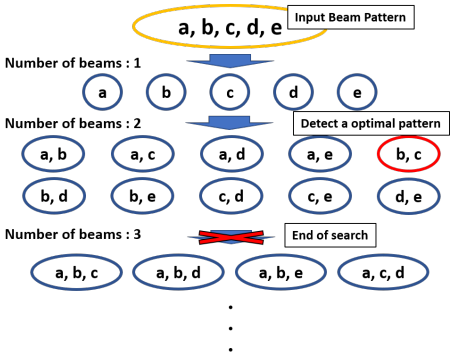

Fig. 1 Image of the Algorithm

Table 1 Number of Beam Calculations

	Maximum data	Total number
No stop condition	794	13311
Subject to stop condition	58	7429

Table 2 Algorithm Evaluation Results

	Number of terminals[units]	Interference area [km^2]
All beam accumulation	1887	9.63
Without the stop condition	1717	8.09
With the stop condition	1717	8.11

[†]The author is with Shinshu University, Japan.
[††]The author is with Akita Prefectural University, Japan.
a) E-mail: takyu@shinshu-u.ac.jp