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Lens Design with the Clustering GA

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The lens design in the real world, it is known that the search space has a multi peak with a lot of big valleys and big mountains. This problem is known as a problem with the deceptive structure. This research's technique is base on Takahashi's technique ANS and Nagata's technique upgrading ANS's Mating List 2 and Mating List 3. The proposed technique is based on these techniques. However Takahashi and Nagata's techniques have revealed that searches cannot be done within a valley, while it is done among different valleys. Therefore, the search efficiency decreases.

This research proposes converting distance that use the distribution of individual agents. The proposed technique deduces the shape of the search space from individual distribution. Specifically, the covariance matrix deduces the distribution of individual agents. This covariance matrix is used for the conversion of the distance. The research purpose is to improve the accuracy of solutions which the individuals compute and to get various solutions.

To evaluate the proposed technique, we conducted experiments which tackle the two dimension optimization problem and the lens designing optimization problem. The two dimension optimization problem is subdivided into three kinds of problems. The first type is comparatively easy. Therefore, it is possible to solve it even with the previous technique. However, it is confirmed that the performance does not change between the previous technique and the proposed technique. In the first function, decrease

of performance has not occurred; this is confirmed from the experiment result.

In the second function problem, there is a queue of three oval valleys. This problem is easy to be selected by the individuals who step over the valleys. In the second function, the propose technique's covariance matrix becomes the shape of a valley near to it. Therefore, the selected individuals stepping over the valley do not take place. And individual was arranged each valley. And the number of individuals in clusters becomes uniform.

The third function has valleys of different shapes. In this problem, each valley has a different shape. In the third function, the proposed becomes the shape of the valley near to it. Therefore, the selected individuals stepping over the valley do not occur. And individuals are arranged in each valley.And clusters' individuals become uniform.

The next optimization problem is a lens designing optimization problem. Lens designing problem is experimented with two kinds of problems. The first lens designing problem is 3 lens system designing. In this problem, The proposed technique provides the best accuracy of the solution. This result is attained by the covariance matrix matches with the shape of the valley. In various solutions, the existing technique is better than the upgraded technique. But the upgraded technique becomes more uniform. And the ANS based upgraded technique converges on one point.

The second lens designing problem is 4 lens system designing. In this problem, the upgraded technique shows the best accuracy of solution. But there is too no difference. Regarding various solutions, the exiting techniques are better. But this result is because covariance matrix search valley. Therefore, the upgraded technique has decreased various solutions. The upgraded technique becomes uniform about clusters' individuals.

Therefore, the proposed technique advances in the accuracy of solution. However the proposed technique is inferior in terms of various solutions. The proposed technique advances in the uniform distribution of clusters' individuals.