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Multi Objective Optimizaion of Shape Design of Wing in Viscous Flow Using GA

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In the past, the wing design has based on the experience of the designer, old data, etc. However, it has be possible to handle as a numerical optimization problem combining with CFD by the development of the computer in recent years.

However, the optimization problem has be paid attention and researched actively as a technique of the design aid, though it has not spreaded. Practically, it is necessary for the optimization problem to consider a lot of restrictive conditions expect for objective of optimization. In that, there are a lot of problem which can not formulate even if it is understood that it is important. Moreover, there are a lot of case that is difficult to obtain the best solution even if it can be formulated. In a word, there are the following problems in the numerical processing of the problem of optimization.

- Difficulty of strict formulation of design problem.

- Difficulty of obtaining the best solution from formulated problem.

The former is pointed out what you should evaluate is not decided easily. The latter is pointed out that obtaining the solution by the numerical technique from the target function which have multi peaks is extremely difficult. Like this, one of the factor that makes formulating the problem difficultly is to provide for a multi objective function. However, it is a little case that the object of design is to satisfy only one performace. For example, the design of wing becomes a compound optimization problem that has various elements which are aerodynamic(lift and drag) and structural. There is multi objective Genetic Algorithm as a technique which is improved in a part of above problem. Multi Objective GA is a GA expanded into a multi objective problem. Multi Objective GA can look for sets of pareto best solutions at the same time according to the characteristic of

search by sets of GA and can offer the designer trade-off information between each objects clearly.

GA has a problem that the calculation time is large. Because, it repeats evaluation of the individual. Therefore, it is an important problem whether GA efficiently searches for the best solution devising each operator of it. Moreover, the design variable to define shape should use a continuous variable, because the performance of the wing changes greatly by a few shape changing. But, GA is fit the combined optimization so that it originally have a discrete search space. Although GA has applied to the problem with a continuous design space because of the robust height,the device is necessary for the treatment of the real number variable and the examination is not performed enough. Then, the following were done in this research.

- I used Adaptive Real Range GA based on the bit expression method which handle real number as a technique of optimization.

- I seted the value of the system parameter and elite preservation method that Adaptive Real Range GA works effectively by the experiment.

- I made Adaptive Real Range GA correspond to the multi objective optimization problem.

- I constructed the multi objective shape optimization problem of wing.

- I decided wing with an excellent performance from information on a lift, drag, and the thickness of the it.