

A study of optimization for automotive parts and structures by using inertia relief

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Abstract

The topology analysis method was developed to optimize the part shape and configuration of automotive components [1]. The key point of the method is to embed solid elements in a model made of shell elements for topology optimization. Improvements of static stiffness were verified for a simple cylindrical model, automotive floor model and full vehicle model. However, in addition to static stiffness using constraints, stiffness while driving is required in the body stiffness of a full vehicle. Inertia relief is known as a method for the expression of behaviour while driving.

In this study, stiffness optimizations by using inertia relief were carried out for an automotive full vehicle model. Specifically, the optimized automotive components were the joints linking a side-member and a cross-member. These components are made of steel sheets and have rectangular cross sections.

The results show that the developed topology optimization method, in which solid elements are embedded in a model consisting of shell elements, is valuable in the optimization of automotive rectangular steel sheet components by using inertia relief. The points of difference and similarity between the static stiffness using constraints and the stiffness using inertia relief were clarified by the optimization results.

References

- [1] Saito, T., Hiramoto, J., and Urabe, T.: Development of Optimization Method for Automotive Parts and Structures, SAE Technical Paper 2014-01-0410, 2014.