Advanced Science and Technology Letters
Vol.140 (GST 2016), pp.62-65
http://dx.doi.org/10.14257/astl.2016.140.13

Durability Study on Turnbuckle Applied with Fatigue Load

Jae Ung Cho[1] and Kye Kwang Choi[2]

[1Corresponding Author] Division of Mechanical & Automotive Engineering, Kongju National University, 1223-24, Cheonan Daero, Seobuk-gu, Cheonan-si, 30180, Chungnam of Korea
jucho@kongju.ac.kr
[2]Department of Metal Mold Design Engineering, Kongju National University, 1223-24, Cheonan Daero, Seobuk-gu, Cheonan-si, 31080, Chungnam of Korea
ckkwang@kongju.ac.kr

Abstract. In this paper, the fatigue damage areas which may occur in 3 types of models are predicted. At the analysis result of this paper, the fatigue property at model 3 with the jointless configuration is shown to be adequate by showing the excellent result at the environment of high vibration. The result of this paper can contribute to safe design by setting the state that applies the fatigue load of turnbuckle used in towing vehicles.

Keywords: Fatigue load, Fatigue life, Turn buckle, Finite element analysis

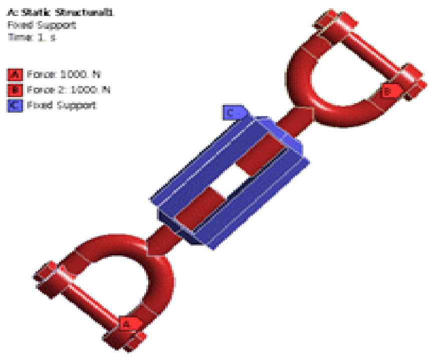
1 Introduction

In this paper, 3D analysis models were made according to the form of turnbuckle for car towing with regards to the damage area which may occur when exposed to the same fatigue environment. Through fatigue analysis, the preceding data was secured prior to the actual experiment by using turnbuckle. Cost and time can be reduced on the basis of it. By predicting the damage area of the turnbuckle through such simulation analysis, it is expected to contribute to safe design [1,2].

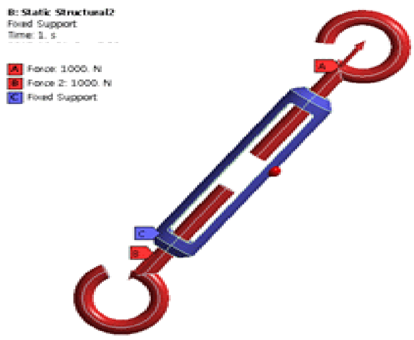
2 Analysis Model and Study Result

Fig. 1 indicates the simulation models used in the analysis and is comprised of models 1, 2 and 3 with different types. Model 1 uses bolts while models 2 and 3 use the separate hooks to connect and all the three types of models has the adjustment part comprised of the left and right screws to adjust tension. In addition, Fig. 1 refers the application of the load for towing the vehicle prior to applying the fatigue load to the analytical model. Tension applies with the force of 1000N on the directions of binding parts by being fixed to the connecting part.

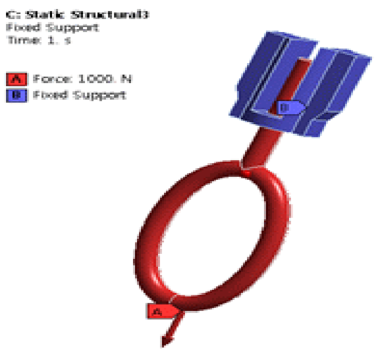
ISSN: 2287-1233 ASTL



(A) Model 1

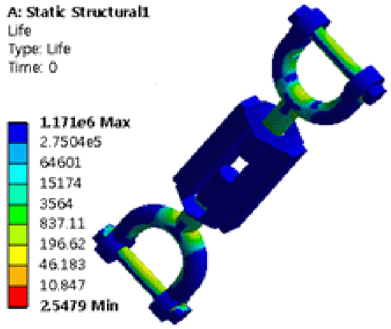


(B) Model 2

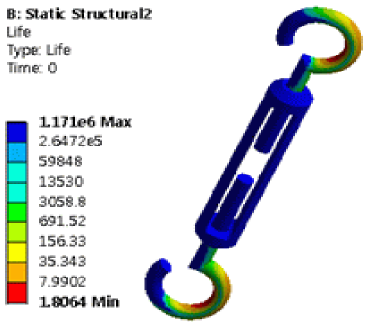


(C) Model 3

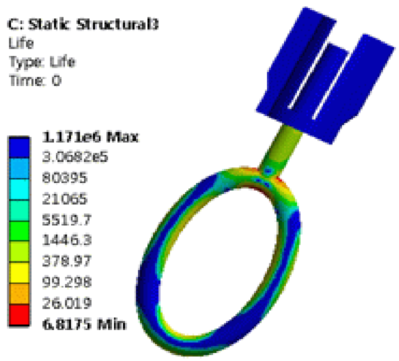
Fig. 1. Analysis model and condition



(A) Model 1



(B) Model 2



(C) Model 3

Fig. 2. Contour of fatigue life at each model

Fig. 2 shows the contour of fatigue life at each model. The contours of fatigue lives are shown st models of 1, 2 and 3. Model 3 of 'O-shape' has higher fatigue life than the other models. Through these results, the fatigue property of turnbuckle is investigated due to existence or nonexistence of turnbuckle joint [3-7].

3 Conclusion

This paper investigates the stress and damage at each model with regards to the external force and fatigue load applied by depending on the shape of the turnbuckle used in towing vehicles. This study was able to identify the following conclusions as the result by conducting the structural and fatigue analyses based on 3D models.

As the study result, the hook-type of model 2 was structurally unstable even when the fatigue load was not applied. Also, for 'O-shaped' model 3, the fatigue life at the neck part was small. Through this study result, the fatigue property becomes different due to existence or nonexistence of turnbuckle joint. It is obtained analytically that the fatigue property can be better when the jointless configuration of O-shape is used among these models. This study result can be applied to the foundation data on the structural safe design of turnbuckle at fatigue.

References

1. Werner Ö., Ingrid U.: Third body formation on brake pads and rotors. Tribology International. 39, 401--408 (2006).
2. Cho, H. S., Cho, J. U., Kim, K. S., Choi, D. S.: Structurally safe design of rear seat frame applied with high tension steel plate, International Journal of Digital Content Technology and its Applications. 7, 444--450 (2013).
3. Rinker, M., John, M., Zahlen, P. C., Schauble, R.: Face sheet debonding in CFRP/PMI sandwich structures under quasi-static and fatigue loading considering residual thermal stress. Engineering Fracture Mechanics. 78, 2835--2847 (2011).
4. Cho, J.U., Hong, S.J., Lee, S. K., Cho, C.: Impact fracture behavior at the material of aluminum foam. Materials Science and Engineering: A. 539, 250--258 (2012).
5. Han, M. S., Choi, H. K., Cho, J. U., Cho, C. D.: Fracture property of double cantilever beam of aluminum foam bonded with spray adhesive", Journal of Mechanical Science and Technology. 29, pp. 5--10 (2015).
6. Parida, S. K., Pradhan, A. K.: 3D finite element analysis of stress distributions and strain energy release rates for adhesive bonded flat composite lap shear joints having preexisting delaminations, Journal of Mechanical Science and Technology. 28, pp. 481--488 (2014).
7. Yoon, S. J., Choi, N. S.: High Cyclic Fatigue Life and Fracture Behaviors of Shot-Peened Bearing Steel. Journal of the Korean Society of Mechanical Engineers. 35, pp. 1119--1129 (2011).

