Visco-elasto-plastic characteristics of ETFE film sheet under temperature change in biaxial tensions

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Abstract

In this paper, we will focus on visco-elasto-plastic characteristics under temperature changes in a biaxial tension state using both experiments and numerical analyses.

First, the constitutive equations are proposed to consider the plastic characteristics into consideration. They are extended to investigate the characteristics under a biaxial stress state; in other words, an extension of the previous studies[1,2] to nonlinear incremental visco-elasto-plastic constitutive equations in a way that the equations can be implemented into a FEM scheme. The proposed constitutive equations for FEM makes it possible to clarify the structural characteristics of ETFE film for roofs under all of time, temperature changes, and elasto-plastic characteristics.

Second, biaxial creep tests under repeated temperature change are shown, and the test results are compared with those based on a set of numerical simulations using the proposed constitutive equations. Finally, the validity and applicability of the proposed constitutive equations will confirm.

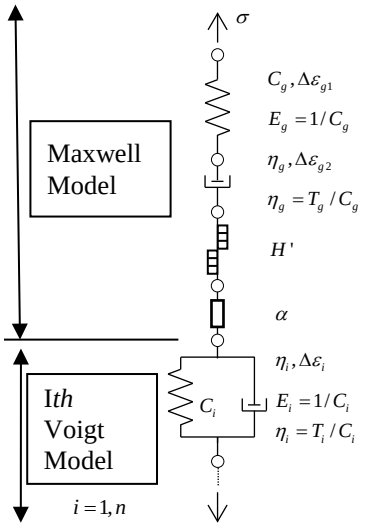

Figure.1 Generalized Voigt model

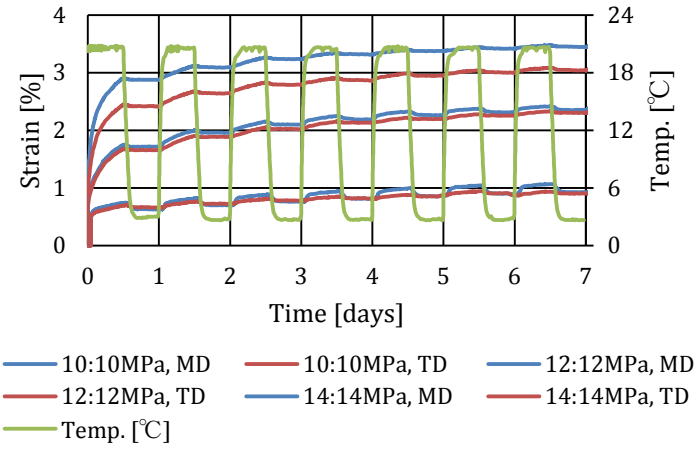

Figure. 2 Test of biaxial creep under stress ratio (1:1) of constant stress 10, 12, 14MPa for cyclic temperature from 2.8℃ to 20.4℃

References

[1] *Yoshino T., Kato S.*, Viscous characteristics of ETFE film sheet under temperature change [PDF file], *STRUCTURAL MEMBRANES 2017*, pp. 253-264, 2017, Retrieved from http://congress.cimne.com/membranes2017/frontal/Doc/Ebook2017.pdf

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