PHOTOELASTIC AND MODELLING OF STRESSES ON A DOUBLE NOTCHED SPECIMEN

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ABSTRACT

This work compares the stress field obtained experimentally on the analyzer of a polariscope with the stress field obtained by using the finite element analysis for a double notched specimen. The isochromatic and the isoclinic fringes allow to determine respectively the stress values and the principal stresses directions in the model. Good agreement is obtained between the experimental and the finite element solution.

Keywords: birefringence, photoelasticity, isochromatic, isoclinic, stress.

INTRODUCTION

The double refraction phenomenon, also known as birefringence, is used to analyze stresses developed in a double notched birefringent plate subjected to a tensile load. It is very important to determine the type and the amplitude of imposed stresses in order to improve the design and the durability of mechanical parts. However, theoretical studies of contact stresses are in some cases very complex. Experimental and numerical solutions have been used by various authors to tackle this problem. In this paper, we are interested mainly in validating a finite element solution so that problems with more complicated geometry and boundary conditions can be numerically solved.

RESULTS AND CONCLUSIONS

The stress field is applied to the specimen via a loading frame. The plate, loaded in tension, is then set in the light path of a polariscope in order to obtain the isochromatic and the isoclinic fringes which allow to determine respectively the stress values and the principal stresses directions in the model, figure 1.

Fig. 1 - Finite element analysis (left); experimental fringes obtained on a polariscope (right)
This experimental procedure is, however, time consuming; a finite element solution is developed in order to analyze stresses rapidly and accurately. We considered that the model material behaves everywhere as a purely elastic isotropic material. Using Mohr circle for plane stress and the basic relations of photoelasticity one can calculate easily the simulated photoelastic fringes. Relatively good agreements are achieved between the experimental and the finite element solution.

REFERENCES


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