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HOOK-SHAPED TRANSDUCER

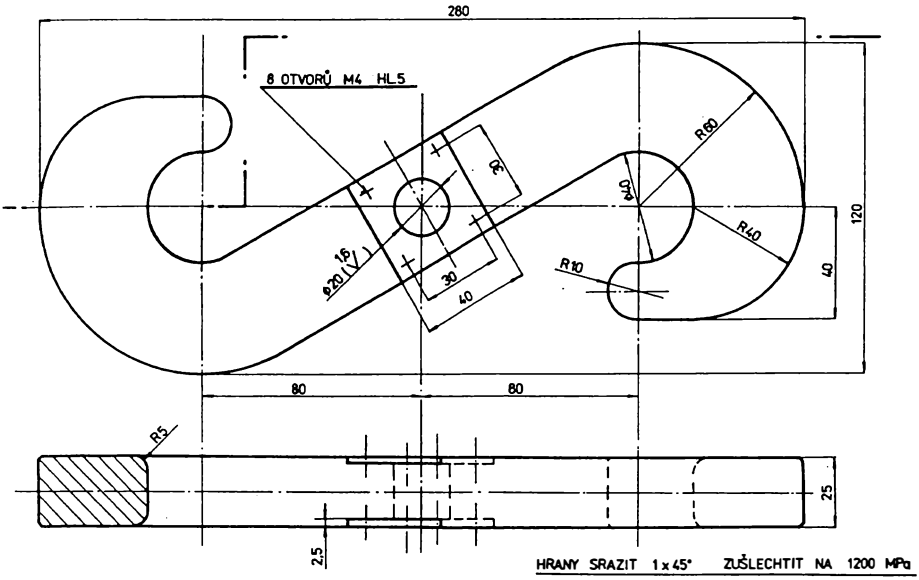
Macura P., Krčál O.

Abstract:

The paper is devoted to the design of the hook-shaped transducer by means of two methods of experimental stress analysis - photoelasticity and strain gauge method.

1. Introduction

Practice often requires rapid and simple measurement of load forces or of mass of suspended body gripped by rope or chain sockets. A hook-shaped transducer was designed for these purposes and it was used mainly for simulation and measurement of a wind load in trees.



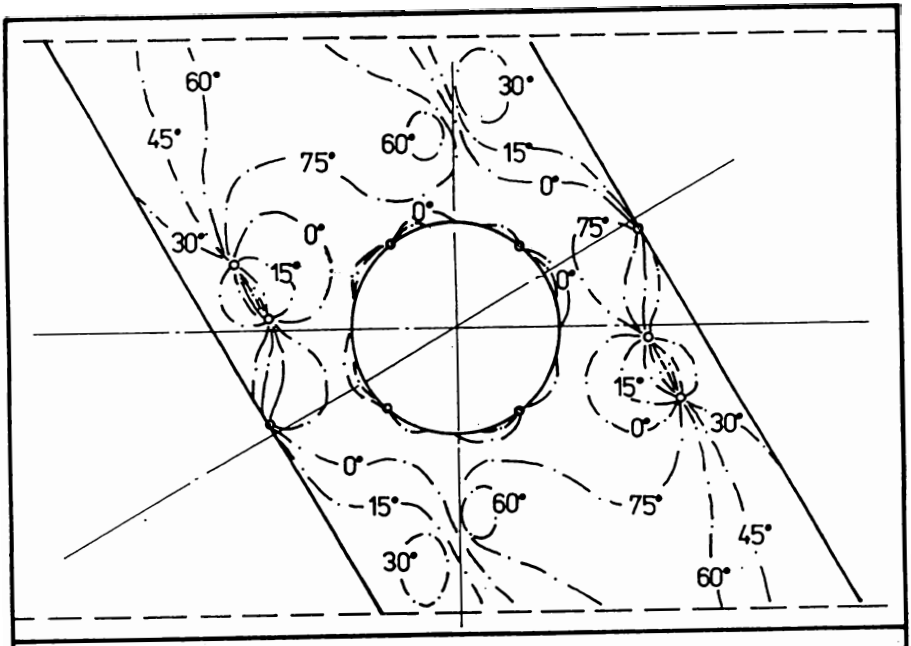


Fig. 2 : Isoclinic lines

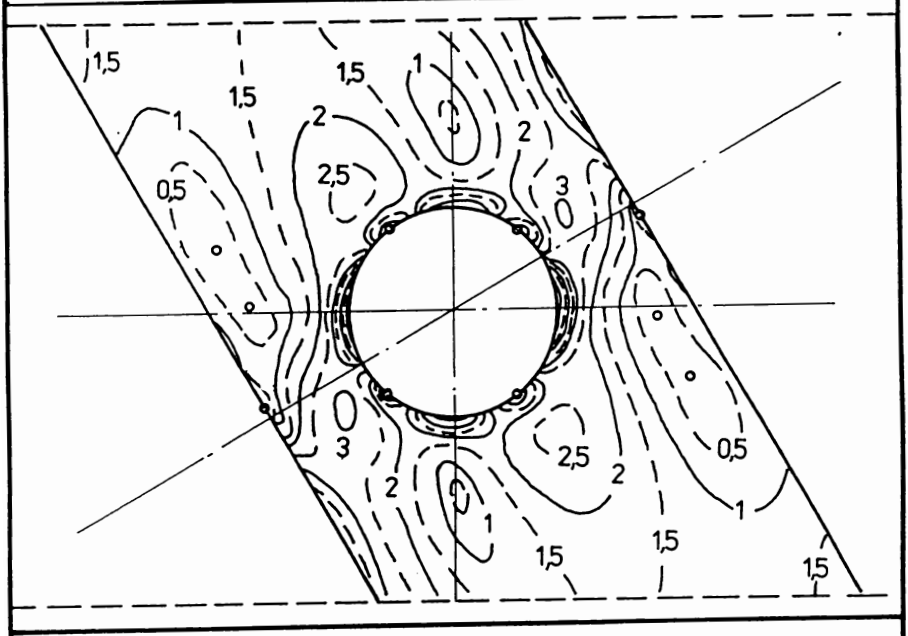


Fig. 3 : Isochromatic lines

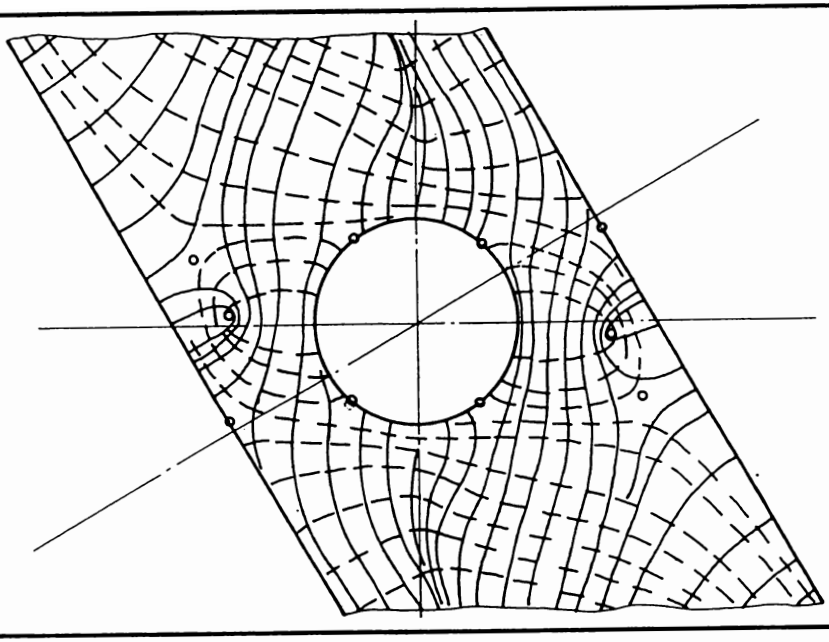


Fig. 4 : Isostatic lines

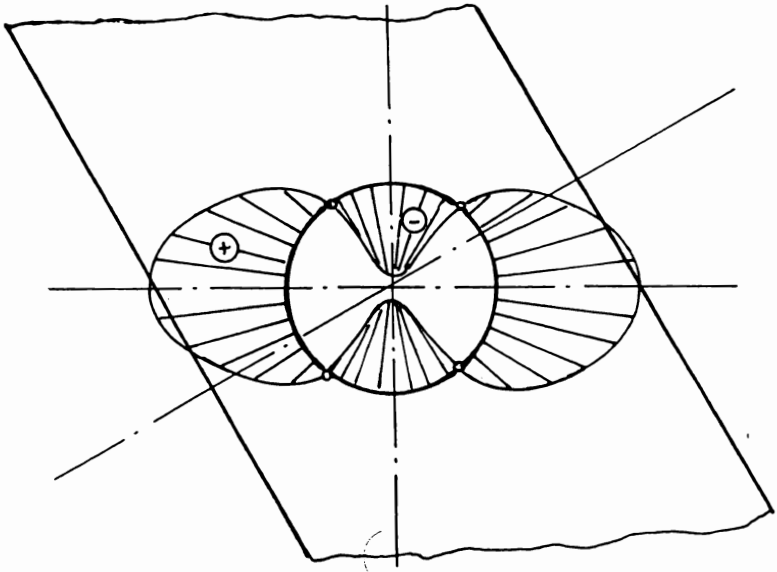


Fig. 5 : Boundary stress

2. Design of sensor from the viewpoint of its rigidity and structure

Structural design of the sensor is given in the Fig. 1. Hook is reduced in the middle by a round hole in which tensometric bridge for measurements of load forces is glued on. Our effort was to design the size of the round hole diameter in such a way that its neighbourhood is not the weakest part of the hook. We had therefore effected photoelastic measurements on the model manufactured form optically active material CR 39. It was concluded from the results of measurements that the maximum stress inside the hole is approx. by 40% lower than the maximum load at the inside surface of the hook.

We have effected more detailed analysis of state of stress for correct selection of points for gluing of strain gauges in the neighbourhood of the round hole. The measured course of isoclinic lines is given in the Fig. 2, re-drawn course of isochromatic lines is shown in the Fig. 3. As it can be seen from the Fig. 2, ten singular points emerge in the neighbourhood of the round hole, out of which four are ate the hole's perimeter where the sign of perimetric normal stress changes. Fig. 4 shows plotted course of isostatic lines.

Course of normal stresses along the round hole perimeter was plotted from the picture of isochromatic lines as it is shown in the Fig. 5. Strain gauges were glued in points of maximum values of tensile and compressive stresses.

3. Conclusion

Due to the fact that sensor consists practically only of one piece, the contact surfaces have no negative impact and sensor embodies very good linearity even in the area of small loads. Model was loaded till rupture and it has really occurred in the zone of the hook's curvature. The sensor has versatile utilisation at practical measurements.

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Pavel Macura, Prof.Ing.DrSc., Otakar Krčál, Ing.
Department of Elasticity and Strength of Engineering Faculty at the VŠB-TU Ostrava, tř. 17. listopadu 15, CZ 708 33 Ostrava-Poruba,
Czech Republic

tel.: +420-69-699-1111, Fax: +420-69-691-6490