

FL 200

Photoelastic Experiments with a Transmission Polariscope



Technical Description

Photoelasticity is a tried and proven method of analysing and recording mechanical stresses and strains in components. It is deployed for quantitative measurement and to demonstrate complex stress states. The components used are models made of transparent, photoelastically sensitive plastic which becomes optically double-refractive under mechanical loading.

FL 200 is used to perform photoelastic experiments on flat, transparent plastic models. The models are subjected to loading by external forces, and have circular polarised light shone through them. An analyser analyses the light which has penetrated the body.

The experimental setup comprises the following components: A light source, four filters (to generate circular polarised light) and a frame inside which the models are attached and subjected to loading. The light source optionally permits coloured stress patterns with white light or light / dark representation with monochromatic light.

The combination of a polarisation filter and a quarter wave plate generates circular polarised light. Behind the model is a second quarter wave plate (perpendicular to the first one), combined with a second polarisation filter. The filters are mounted on rotating bearings and provided with angle scales.

Various models are mounted inside the frame. A load application device applies bending, tensile or compressive load to the model by way of a spindle. Stresses and strains occurring in the model are identifiable as bright spots, visualising the distribution of stress. To determine the principal stress difference, the order of the dark isochromatics is evaluated.

FL 200 permits flexible experimental setups even with self-made models.

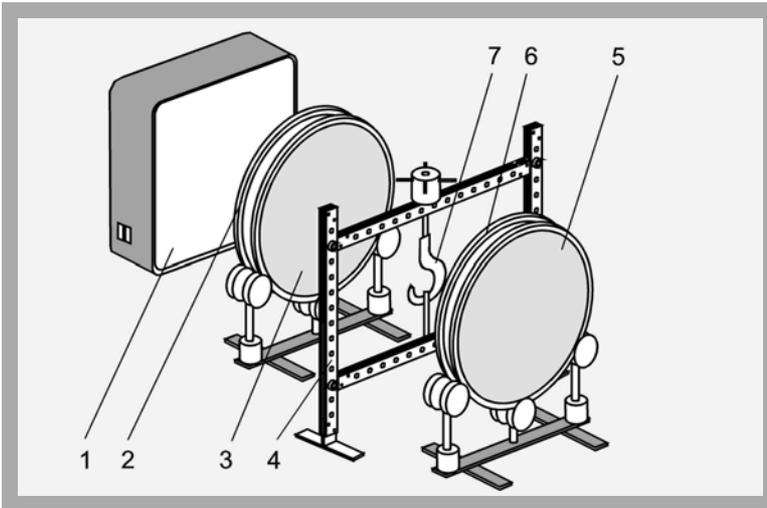
- * **Photoelastic experiments on models subjected to mechanical loading**
- * **Monochromatic or white-light illumination**
- * **Creation of stress patterns with plane or circular polarised light**
- * **Determination of principal stress difference**
- * **Various plastic models as accessories, e.g. wrench, bow, notched bars**
- * **Models to investigate specific issues can be easily made by users**
- * **Well structured instructional material**

Learning Objectives / Experiments

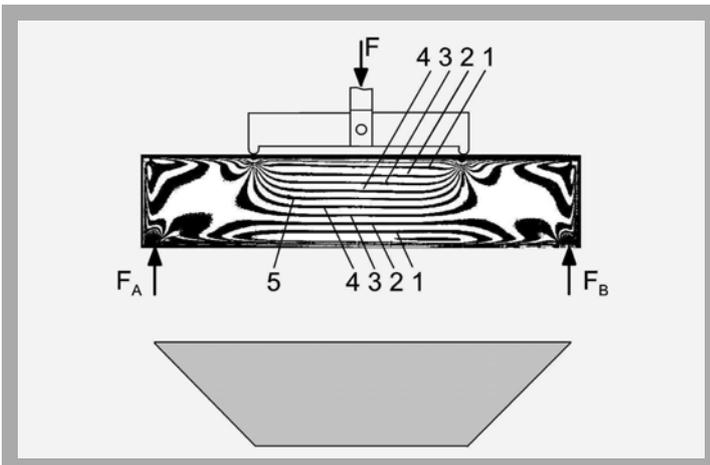
- Generation of planar stress states in various models under load
 - * bending, tensile load, compressive load
- Investigation of diffusion of stresses with plane or circular polarised light
- Interpretation of photoelastic fringe patterns
 - * stress concentrations, zero points, neutral fibres, areas of constant stress, stress gradients
- Determination of occurring stresses and strains graphically and arithmetically

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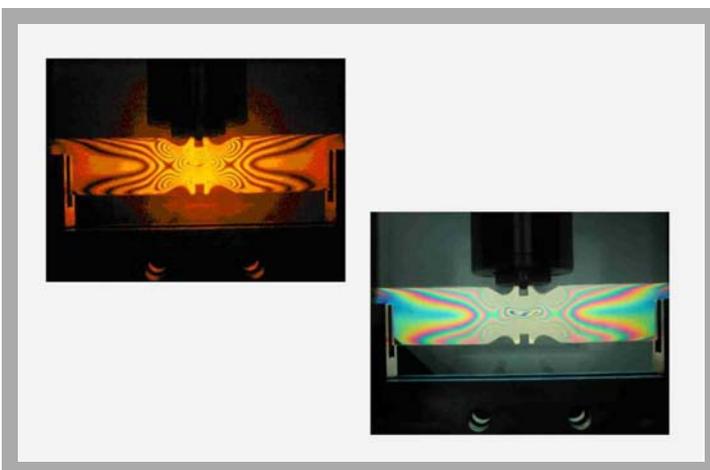
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1 light source, 2 polarisation filter as polariser, 3 quarter wave filter, 4 frame to clamp and apply load to the models, 5 polarisation filter as analyser, 6 quarter wave filter, 7 model under load (FL 200.03)



Top: distribution of stress in the model under bending load: 1 to 4 isochromatic layout, 5 neutral fibres, F external force, F_A/F_B support reactions;
bottom: bending moment curve



Top: model of a notched bar (FL 200.05) in monochromatic light,
bottom: model FL 200.05 in white light

Specification

- [1] Representation of mechanical distribution of stress in photoelastic experiments
- [2] 2 plane polarisation filters as polariser and analyser
- [3] 2 quarter wave filters to generate circular polarised light
- [4] All filters with 360° angle scale and marking of the main optical axis
- [5] White light generated using a fluorescent tube and two incandescent lamps
- [6] Monochromatic light (colour yellow) generated using a sodium vapour lamp
- [7] Filters roller bearing mounted and rotating
- [8] Frame cross-arms height-adjustable
- [9] Generation of compression or tension forces by means of a threaded spindle
- [10] Complete models in polycarbonate (PC) for demonstration purposes available as accessories

Technical Data

- Light source
- lamp box with white diffuser
 - for white light
 - 1 fluorescent tube TL-E 32W/33 (colour: 33)
 - 2 incandescent lamps, candle bulb, matt inner E14, 235V, 25W
 - for monochromatic light (colour yellow)
 - 1 sodium vapour lamp SOX 35, 35W
- Filter, enclosed in glass, diameter: $d=425\text{mm}$
- 2 polarisation filters (dark olive)
 - 2 quarter wave filters (colourless)
- Frame w x h: 600x750mm

Dimensions and Weight

l x w x h: 800 x 600 x 750 mm
Weight: approx. 50 kg

Connections

230V, 50/60Hz, 1 phase or 120V, 60Hz/CSA, 1 phase

Scope of Delivery

- 1 frame with load application device
- 2 polarisation filters
- 2 quarter wave filters
- 2 filter holders
- 1 light source
- 1 set of instructional material

Order Details

021.20000 FL 200 Photoelastic Experiments with a Transmission Polariscope

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Available accessories and options:

Item no.	Description
021.20001	FL 200.01 Set of 5 Photoelastic Models, PC
021.20002	FL 200.02 Model - Arch, PC
021.20003	FL 200.03 Model - Crane Hook, PC
021.20005	FL 200.05 Set of 3 Photoelastic Models, PC, Comparison of Notches
021.20006	FL 200.06 Model - Stresses on Weld Seams, PC
021.20007	FL 200.07 Model - Wrench, PC

All models are supplied with the necessary fixings.

021.20012	FL 200.12 Photoelastic Model Material in Panels 650x400x10mm, PC
021.20082	FL 200.81 Ring Dynamometer 500N
021.20083	FL 200.83 Ring Dynamometer 1000N
021.20084	FL 200.84 Ring Dynamometer 2000N