

FL 200

Photoelastic experiments with a transmission polariscope



The illustration shows the experimental unit together with the model from FL 200.03.

Learning objectives/experiments

- together with the accessories or your own models:
 - ▶ generate plane stress states in various models under load: bending, tensile load and compressive load
 - ▶ investigate stress distributions with linear or circular polarised light
 - ▶ interpret photoelastic fringe patterns: stress concentrations, zero points, neutral strands, areas of constant stress and stress gradients
 - ▶ graphically and computationally determine the stresses

Description

- monochromatic or white light
- generate stress patterns with linear or circular polarised light
- models for specific problems can be prepared by the user

Photoelasticity is a proven method of analysing and recording mechanical stresses and strains in components. It is used both for quantitative measurements and for demonstrating complex stress states. The components used are models made of a transparent, photoelastically sensitive plastic, which becomes optically birefringent under mechanical load.

FL 200 is used to conduct photoelastic experiments on plane, transparent plastic models. The models are subjected to load by external forces, and they are radiated by circular polarised light.

An analyser analyses the light penetrating the body.

The experimental setup comprises the separate components: a light source, two linear polarising filters (polariser and analyser), two quarter-wave filters and a frame in which the models are attached and subjected to load. The light source optionally permits coloured stress patterns with white light or a light/dark representation with monochromatic light.

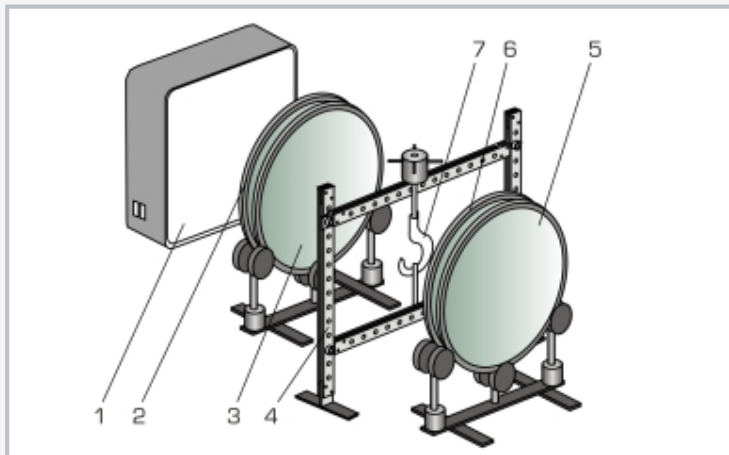
The polariser includes a polarising filter and a quarter-wave plate and generates circular polarised light. Behind the model is a second quarter-wave plate (perpendicular to the first one), which is combined with a second polarising filter. These form the analyser. The filters are mounted on rotating bearings and fitted with angle scales.

Various polycarbonate models are mounted inside the frame. A load application device applies bending, tensile or compressive load to the model through a spindle. Stresses and strains occurring in the model are identifiable as bright spots, visualising the distribution of stress. The order of the dark isochromats is analysed to determine the principal stress differential.

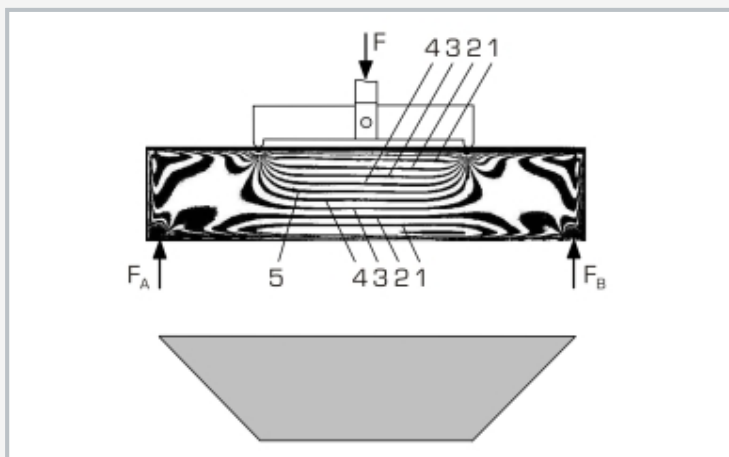
A wide selection of models such as notched bars, a wrench and a model-roller bearing or a rack-and-pinion is available as accessories. These ensure the implementation of comprehensive experiments. It is also possible to investigate your own models.

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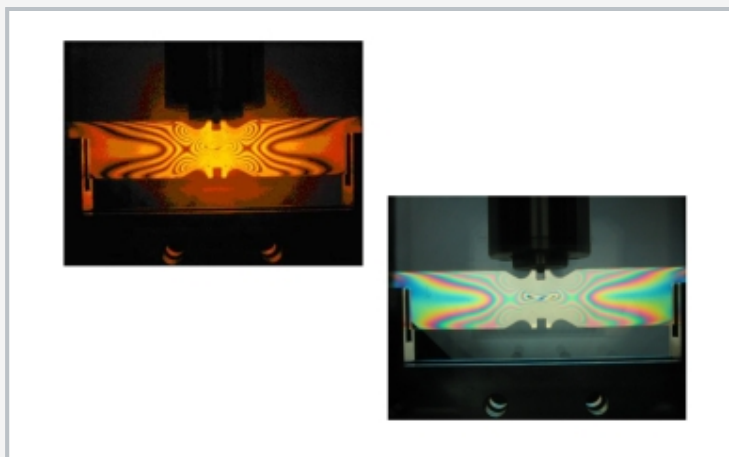
Photoelastic experiments with a transmission polariscope



1 light source, 2 polarising filter as polariser, 3 quarter-wave filter, 4 frame for clamping and loading the models, 5 polarising filter as analyser, 6 quarter-wave filter, 7 model under load (FL 200.03)



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



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

Specification

- [1] produce the mechanical stress curves through photoelastic experiments
- [2] 2 linear polarising filters (polariser and analyser)
- [3] 2 quarter-wave filters for generating circular polarised light
- [4] all filters have 360° angle scale and indicate the main optical axis
- [5] filters mounted on roller bearings and can be pivoted
- [6] white light produced by a fluorescent tube and two incandescent bulbs
- [7] monochromatic light (yellow) generated by sodium vapour lamp
- [8] frame cross-members can be vertically adjusted
- [9] pressure or tensile forces generated by a threaded spindle
- [10] finished polycarbonate (PC) models available as accessories for the demonstration

Technical data

Light source

- lamp box with white diffuser
- for white light
 - ▶ 1 fluorescent tube TL-E 32W/33 (colour: 33)
 - ▶ 2 incandescent bulbs, candle lamp, frosted E14, 230V, 25W
- for monochromatic light (yellow)
 - ▶ 1 sodium vapour lamp SOX 35, 35W

Filter, mounted in glass, diameter: \varnothing 425mm

- 2 polarising filters (dark olive)
- 2 quarter-wave filters (uncoloured)

Frame: WxH: 600x750mm

230V, 50Hz, 1 phase

230V, 60Hz, 1 phase; 120V, 60Hz, 1 phase

UL/CSA optional

LxWxH: 800x600x750mm

Weight: approx. 58kg

Scope of delivery

- 1 frame with load application device
- 2 polarising filters
- 2 quarter-wave filters
- 2 filter mounts
- 1 light source
- 1 set of accessories
- 1 set of instructional material

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Optional accessories

WP 300.09	Laboratory trolley
FL 200.01	Set of 5 photoelastic models
FL 200.02	Model arch
FL 200.03	Model crane hook
FL 200.05	Set of 3 photoelastic models, comparison of notches
FL 200.06	Model stresses on weld seams
FL 200.07	Model wrench
FL 200.12	Photoelastic material
FL 200.81	Ring force gauge 200 N
FL 200.82	Ring dynamometer 500N
FL 200.83	Ring dynamometer 1000N
FL 200.84	Ring dynamometer 2000N