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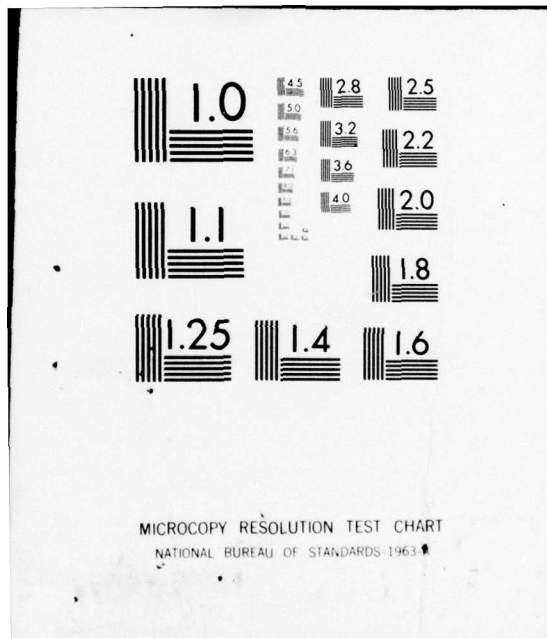
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ANALYSIS OF STRAIN HISTORIES IN STRUCTURES. (U)
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Analysis of Strain Histories in Structures:

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B.S.

Feb 23 1976.

Final Report, June 01 1974 - May 31 1975.

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Prepared for:

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and

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Analysis of Strain Histories in Structures

Final Report

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Introduction:

The programme reviewed in this report was aimed at fulfilling a need perceived throughout the engineering industry, with particular reference for the aircraft designer; namely a technique for reliably measuring the deformations in structures under load. Such a system, now known as Optecord (an acronymic contraction of Optical Strain Recording) has been developed and field tested.

Scientific Basis:

Optecord is a moire' system, and as such depends upon a reference grid being attached to the specimen. . The grid follows the specimen deformation, and by comparison of the deformed grid with a master grid, the magnitude of strain over a whole area can be seen as a set of contour lines. The advances made during this programme consist of the development of a superior form of specimen grid which can reliably be used in almost any weather conditions, and of a replication method for acquiring the deformed grid data for comparison with the master. This comparison is carried out in an interferometer which multiplies the sensitivity obtained from the basic grid by a factor ranging between 15 and 50. By this means, an adequately sensitive measurement of engineering strain is possible. The system has already been described in detail in a previous Scientific Report (January, 1975).

Applications:

The system has been used successfully on road bridge, aircraft and oil-rig type structures, and for materials investigations, fatigue and fracture studies.

Future Developments:

A high temperature grid system is being developed which will take the operating temperature of the grids up to 1000°C, when monitoring of steam and gas turbine components will be possible. In addition a readout head for instant site readout of strain is under consideration.

Publications:

- 1) Interim Scientific Report AFOSR-73. dated Jan. 1975.
- 2) SESA Annual Conference, Chicago, May 1975. (submitted for publication in Experimental Mechanics).
- 3) British Society For Non-Destructive Testing, Annual Conference, Sept. 15, 1975, Cardiff.
- 4) Chartered Mechanical Engineer (to be published).
- 5) Strain (to be published).
- 6) British Journal of Non-Destructive Testing (to be published).

Communication with Wright-Patterson Air Force Base, Flight Dynamics Laboratory

Following the submission of the Final Scientific Report in January 1975, the Principal Investigator Dr. C.A. Walker, and Dr. J. McKelvie, paid a visit to the Photomechanics facility of the Flight Dynamics Lab at Wright-Patterson Air Force Base. A full discussion of the Optecord system took place, with mutual indication of areas of potential application.

During the same trip, a Seminar on Optecord was given at the Naval Research Lab, Ocean Technology Div, in Washington D.C.

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) → A method for measuring strain contours on structures has been developed and tested. Based upon a multiplied moire' fringe technique, it uses a relief grating on the specimen and a replication technique to acquire the deformed grid data for subsequent analysis in a fringe-multiplying interferometer.			