9. Publications

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Continuous model mild steel beams under cyclic deflection
(M.M. Ghamian, A.N. Sherbourne)

The paper predicts the load response of a section in an indeterminate structure when subjected to cyclic reversals of the strain control type. In this particular case the structure consists of a three equal span, continuous, rectangular, model mild steel beam acted upon by a central load oscillating between predetermined deflection limits. The range of reversed central displacement may be symmetric or unsymmetric about the reference position. A Moment-Strain model is developed which predicts moment (load) variation with life N, delineating elastic or plastic response in the structure depending upon the imposed deflection range. In cases where the mean deformation was relatively large compared with the imposed deformation range, the structure displayed the ability to accommodate this input with little or no increase in the mean moment, thus reproducing the phenomenon of redistribution in a plastic hinge.

Bending of glass fibre-reinforced plastic (GFRP) plates on elastic supports

Part 1: Material Characteristics
(T.H. Topper, A.N. Sherbourne, V. Saari)

This study is concerned with the mechanical properties of a fibreglass reinforced polyester resin of laminar construction with consideration given to the application of the results to the analysis, in bending, of a plate of similar material.

Tension and compression tests were performed to obtain the stress-strain relationship and ultimate stresses and strains. Because of the inherent scatter of results due to the nature of the material, average values, along with maximum and minimum limits, are determined. Flexural tests were conducted and moment-curvature relationships were obtained both theoretically and experimentally. Creep tests showed that, for loads well below the failure load, creep effects are almost negligible when the fibres are oriented to the longitudinal axis of the specimen. As the results in bending are not as scattered as those for tension and compression, this leads one to believe that they might be more appropriate for use in plate theory.

Part 2: Plate behaviour
(A.N. Sherbourne, T.H. Topper, G. Villarreal)

The behaviour of a fibreglass plate, subjected to a simulated hydraulic pressure and supported by a steel frame along the edges through a neoprene gasket, is investigated. The plate is analyzed theoretically as an orthotropic continuum using a direct variational technique in accordance with the Rayleigh-Ritz method. The load-deformation behaviour and the mode of failure is examined experimentally. Theoretical and experimental results are correlated empirically through Poisson's ratio.

Reliability Analysis of Statically Determinate Structures Making Use of Theory of Stochastic Processes

(Nobuyoshi TAKAOKA, Wataru SHIRAKI)

The reliability of structures was analyzed considering both the loads and member strengths to be random processes. Based on theory of thresholdcrossing for multidimensional space, a general formula for evaluating the probability of failure of the system with n structural members, acted on by m loads, was derived. The numerical calculations were carried out on a statically determinate truss. The parameters considered in the calculations are the lifetime of structure, coefficients of variations of both loads and strengths, central safety factors of structural members. The effect of these parameters and of the correlation among the failure modes on the reliability of structural system was shown.

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Bibliography on Torsion in Concrete

The American Concrete Institute has published an annotated bibliography *Torsion in Concrete.* The bibliography gives a comprehensive background to international literature on all aspects of torsion and insight into the work of investigators in the field. With 452 annotated references covering the period 1784 through 1974, it offers a history of research in torsion in bibliographic form.
Torsion in Concrete, ACI Bibliography No. 12, 1978, 148 pages, $ 21.50 (to ACI members $ 11.50). Postage and handling fee $ 1.50. American Concrete Institute, P.O. Box 19150, Redford Station, Detroit, Michigan 48219, USA.