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A NUMERICAL ANALYSIS OF RIGID FRAMES IN SPACE

(Read at the 11th Anual Meeting held by the Society at Fukuoka, May, 29, 1955.)

Shun-ya Yoshida, C.E. Member

Synopsis : Usually, the stresses in rigid frames in space are analyzed on the respective constituent plane systems independently, therefore the torsional resistances of members intersecting to the plane systems under consideration are neglected. But, it is perceived that there are several cases in which some effects of torsional moments may not be neglected. In these cases the structures must be analyzed under their actual states, i.e. three-dimensionally. But, in general, it is so troublesome to analyze the structures three-dimensionally that such analyses are disliked by many enginenrs.

In this paper, it is shown that a numerical analysis derived from the fundamental conceptions of the moment distribution method is a convenient tool to analyze rigid frames in space three-dimensionally.

A CONSIDERATION ON SAFETY OF STRUCTURES BY PLASTIC AND STOCHASTIC THEORY

Dr. Eng., Ichiro Konishi, C.E. Member, Masanobu Shinozuka, C.E. Assoc. Member

Synopsis : In this paper, as one of the fundamental research on safety of structures, the method to estimate the safety of the beam, which is subjected to a single rolling load W prescribed by the probability density function $f(W)$, is proposed.

In this case, it is clarified, from the concept of limit design, that there are two types of failures, the one is static collapse and another is incremental collapse. And the theoretical method to obtain the probability that either static collapse or incremental collapse occurs is represented.

BENDING OF PARALLELOGRAM PLATES

Sadao Komatsu, C.E. Assoc. Member

Synopsis : This paper contains the solution in complex form for the bending of parallelogram plates subjected to the uniformly distributed load as well as the concentrated load under the condition that all sides either are fixed or simply supported.

Some numerical examples are compared with the results given by S. Timoshenko and W. Fuchssteiner, being seen to be satisfactory.

RULE FOR DISTRIBUTION OF KINETIC ENERGY

Dr. Eng., Kazuyosi Ono, C.E. Member

Synopsis : We can solve the vibrations of the various structures, and can express them as normal functions, but generally it is very troublesome to estimate their amplitudes. In this paper the author shows a very simple method for the purpose. When a impact P is imposed on a structure and causes many vibrations in it, a rule of proportionality exists between the kinetic energys T_1, T_2,……of each vibrations and their initial velocities V_1, V_2,……estimated at the point where the impact was imposed, as follows :

$$\frac{2T_1}{V_1}=\frac{2T_2}{V_2}=\cdots\cdots\cdots=P$$

With aid of this rule we can easily estimate the amplitudes of each vibrations.

THE STUDY ON THE STRESSES IN TRUSSES BY THE ELECTRIC CIRCUIT ANALOGY

Riichiro Arai, C.E. Member, Toshihiko Yamauchi, C.E. Assoc. Member

Synopsis : In this paper, the authors describe the similarity between the trusses and their analog circuits, and analyze experimentally the member stresses and deflections of the panel points for a few kinds of trusses.

Experimental results are accurate enough within 3% for the stresses and within 1% for the deflections, respectively.

ON THE DESIGN BENDING MOMENT OF REINFORCED CONCRETE SLAB OF HIGHWAY BRIDGE

Hiroshi Yonezawa, C.E. Member

Synopsis : In this paper the new formulas of the design bending moment of reinforced concrete slab and continuous slab supported by main girder or stringer are induced by the calculation of orthotropic plate and compared with new specification of steel highway bridges (1955). It is a characteristic of new formulas that the effect of main reinforcement is introduced for simple slab and the relative stiffness of the girder to the slab is introduced for continuous slab and in this point the new formulas are more rational in comparison with formulas of new specification or customary design.

STABILITY OF A MEMBER SUBJECTED TO BENDING MOMENT AND THRUST

Dr. Eng., Toshie Okumura, C.E. Member

Synopsis : In this paper the limitation of dimentions of the member subjected to bending moment and thrust like as arch, which is necessary to prevent the local buckling and the column buckling in same safety is studied. In the study of the column buckling especially the effects of the shape of cross sections to its buckling are considered. In general the conventional beam theorem can not be applied to the member, in which the shear center is not situated at the centroid of cross section. And then the idea of the shear center and the bending-torsional rigidity are explained for general so-called open section. In order to establish fundamental three Eulerian equations for the buckling of the member taking account of that ideas, the equilibrium after rotation and displacement is considered, and the theorem of stationary potential energy in which the rules of the calculus of variations are applied is used.

Then the three Eulerian equations show two modes of buckling. One of them is the torsional type, another is the ordinary type, and torsional type contains so-called Wagner's pure torsional buckling value P_t and the lateral Eulerian one P_e. If the shear center is situated at the centroid of cross section, lateral buckling value coincides P_t or P_e. Some numerical examples of unsymmetrical *I* and *II* section show that it is necessary to prevent the drop of lateral buckling strength due to the bending and the eccentrical loading that P_t is higher than P_e. This natures are tested by the experiment of eight columns with unsymmetrical *I* cross section.

ON THE MECHANISM OF DEFLECTING THE FLOW DIRECTION BY THE DEFLECTOR

Toshio Iwasaki, C.E. Member

Synopsis : Theory of the design method of the deflector which can deflect the flow direction on the apron of the dam to the favourable direction for the downstream of a river is explored and the experiments are conducted which results show this theory is reasonably applicable to this problem.

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