ENGLISH SUMMARIES

EQUILIBRIUM EQUATIONS FOR SIMPLE FUNDAMENTAL STRUCTURAL MODELS - part III SHELL STRUCTURES

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Journal of Structural Mechanics, Vol. 29 No. 3-4, 1996, pp. 11-34

In this series of papers, the analysis of various fundamental structural models is considered paying attention to educational purposes, particularly. The expressions for strains are derived by utilizing a local Cartesian coordinate system. The equilibrium equations are derived by applying the principle of virtual work. In this part the program presented is applied to shell structures.

ON SOME LOW-ORDER PLATE BENDING ELEMENTS

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Journal of Structural Mechanics, Vol. 29 No. 3-4, 1996 pp. 51-68

Two simplest models to describe the behaviour of a thin plate are the Kirchhoff and Reissner-Mindlin models. In the development of the finite element methods for plates, some practical difficulties are encountered for both models. The continuity requirement for the slope of the deflection complicates the formulation of Kirchhoff elements, while many Reissner-Mindlin elements suffer from numerical locking and stability problems. In this paper formulations of some simple, but robust Kirchhoff and Reissner-Mindlin plate bending elements are described. Kirchhoff elements presented are based on the discrete Kirchhoff concept, where the inter-element continuity is satisfied in an average sense. For the Reissner-Mindlin plate model three and four node elements are described, which are based on the MITC reduction technique and stabilization, for which a physical explanation is given.

SEISMIC RESPONSE OF STRUCTURES ANALYSED BY RANDOM VIBRATION THEORY

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Journal of Structural Mechanics,
Vol 29, No. 3-4, 1996 pp. 35-50

There are many different important problem areas in evaluating the seismic response of structures. In this study the effort is concentrated on three of these areas.The first task is the mathematical formulation of earthquake excitation. The random vibration theory is taken as the tool in this task. First formulation for earthquake excitation used here is the stationary Filtered White Noise (FWN) presentation. Also evolutionary presentations are investigated and uniform modulation function as well as time-frequency dependent modulation functions are used. The properties of these different presentations for earthquake excitation are examined with the aid of response evaluation of simple structural model using STOCAL code. The second area of interest in this study is the soil-structure interaction analysis. The approach of impedance functions is chosen and the focal point of interest is the significance of frequency dependent impedance functions. The investigation was carried out with the aid of CARES code. The following result was obtained when different possibilities for impedance function representation were evaluated. The description of the soil with the aid of frequency dependent impedance function decreases the structural response when compared to the presentation of the soil with frequency independent impedance functions and the frequencydependent description is thus always the preferred method when compared to more conservative analysis types.The third area of interest is the methods to determine the structural response. The following four methods were tested: 1) The mode superposition time history method; 2) The complex frequency-response method; 3) The response spectrum method and 4) The equivalent static force method. The comparison was made with the aid of MSC/NASTRAN code. The first three methods gave for outer containment building response results which were in good agreement with each other, whereas the equivalent static force method was extremely conservative.