

A SIMPLE CONTINUUM MODEL FOR DYNAMIC
ANALYSIS OF COMPLEX PLANE FRAME STRUCTURES

by

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Dynamic analysis of complex frame structures can be very laborious if all the structural members are to be accounted for. Simple models are commonly employed, which usually ignore joint rotations and the gross bending effect.

This paper presents a simple model for dynamic analysis of large plane frame structures that accounts for both joint rotations and gross bending. The governing equations are derived from a theory for frame works in which a two-dimensional continuum with couple stress is used to represent the plane frame¹. Four equations are obtained for four field variables namely the lateral displacement, the axial displacement, the joint rotation and the gross flexural deformation.

Free vibration of plane frames is investigated by using the simple model and by finite element method. Natural frequencies are computed. Numerical results show that the simple model is capable of yielding accurate frequencies as well as mode shapes up to the fifth mode. The angular frequencies for the first five modes in a 15 story - 4 bay structure are given in the following table.

Mode	1	2	3	4	5
Finite Element Solution	4.26	13.08	23.18	33.03	43.32
Simple Model Solution	4.24	13.20	23.98	34.34	45.32

Reference

1. C. T. Sun and T. Y. Yang, "A Continuum Approach Toward Dynamics of Gridworks," *Journal of Applied Mechanics*, Vol. 40, No. 1, 1973.

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