

# **DYNAMIC SOIL - STRUCTURE INTERACTION OF TALL BUILDINGS**

**G. Q. DAR**

**DEPARTMENT OF CIVIL ENGINEERING  
INDIAN INSTITUTE OF TECHNOLOGY, DELHI**

DYNAMIC SOIL-STRUCTURE INTERACTION OF  
TALL BUILDINGS

by

G.Q. DAR

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CERTIFICATE

This is to certify that the thesis entitled 'Dynamic Soil-structure Interaction of Tall Buildings' being submitted by Mr. G.Q.Dar to the Indian Institute of Technology, Delhi, for the award of the degree of Doctor of Philosophy in Civil Engineering is a record of bonafide research work carried out by him. Mr. G.Q. Dar has worked under my guidance and supervision and has fulfilled the requirements for the submission of this thesis, which to the best of my knowledge has reached the requisite standard.

The material contained in this thesis has not been submitted, in part or full to any other university or institute for the award of any degree or diploma.

*The corrections mentioned in the Viva report have been incorporated.*

 15/5/80

( A.K. Basu )  
Professor of Civil Engineering  
Indian Institute of Technology  
Hauz Khas, New Delhi-110029  
India.

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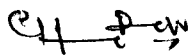
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## ABSTRACT

The dynamic behaviour of flexibly supported symmetrical tall buildings comprising frame-wall systems, coupled walls and coupled wall-frame systems is studied. The building in each case is modelled as a continuum with uniform properties along the height and is assumed to be resting on a rigid circular footing attached to the surface of a linear elastic half space.

Natural frequencies and mode shapes of the fixed base structure in each case are obtained from the solution of a matrix eigenvalue problem corresponding to horizontal displacements at a number of reference levels. The mass matrix is found by lumping the distributed mass at these levels and the stiffness matrix of the system is obtained from the point load solution of the differential equation of static equilibrium of the continuum. The fixed base normal modes are used as co-ordinate functions for describing the displacements of the vibrating structure-foundation systems.

The response to a harmonic base excitation is obtained in terms of nondimensional transfer functions for displacements and stress resultants for a range of frequencies and for various combinations of parameters involved in the problem. Earthquake response is obtained by transforming the earthquake motion into its Fourier components and evaluating

the response in frequency-domain by multiplying the amplitude distribution by the appropriate transfer function. Time histories are then obtained by taking the inverse Fourier transform of the frequency response. Results are given for the earthquake excitation of three building systems both for fixed and flexible base conditions in order to demonstrate the effect of foundation flexibility on the response.

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