NEURAL NETWORK MODELS FOR SITE-SPECIFIC SEISMIC ANALYSIS OF BUILDINGS

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CERTIFICATE

This is to certify that the thesis entitled, "**NEURAL NETWORK MODELS FOR SITE-SPECIFIC SEISMIC ANALYSIS OF BUILDINGS**" being submitted by **P. Kamatchi** to the Indian Institute of Technology, Delhi for the award of the degree of **Doctor of Philosophy** is a bonafide record of research work carried out by her under our supervision and guidance. The thesis work, in our opinion, has reached the requisite standard fulfilling the requirement for the degree of **Doctor of Philosophy**.

The results contained in this thesis have not been submitted, in part or full, to any other University or Institute for the award of any degree or diploma.

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ABSTRACT

The importance of the effect of sediments above bedrock in modifying the strong ground motion has been long recognized. The amplification factors derived out of empirical and theoretical data are region specific and can lead to erroneous results for other places. Building codes are highly simplified tools and do not adequately represent any single earthquake event from a probable source for the site under consideration. It has been recommended that in addition to use of codal provisions, site-specific analysis which includes generation of strong ground motion at bedrock level and propagating it through soil layers and arriving at the design ground motions and response spectra at surface should also be carried out. However, the site-specific analysis is too involved for everyday design. Powerful capabilities of ANN have been utilized for various civil and structural engineering applications. In the present work, neural network based methodologies have been proposed to rapidly estimate site-specific seismic response of both torsionally uncoupled and torsionally coupled buildings. The methodologies have been demonstrated for capital city Delhi for a scenario earthquake from Himalayan region. Prior to this, the importance of site-specific analysis for Delhi region has been demonstrated.

A neural network based methodology has been proposed to rapidly estimate site-specific spectral acceleration for torsionally uncoupled framed and shear wall buildings. Two neural networks have been developed using 99,630 patterns for prediction of surface level site-specific spectral acceleration. The performance of the neural networks has been validated for a number of torsionally uncoupled example framed buildings. The weights and biases of the trained networks and a user friendly program have been given for use in every day design.

Site characteristic has been identified as a factor that influences the dynamic to static eccentricity ratio of torsionally coupled buildings. Studies have been carried out on two torsionally coupled buildings on three soil sites at Delhi, for scenario earthquakes. Neural network based methodology has been proposed to rapidly estimate dynamic to static eccentricity ratio of torsionally coupled framed and proportionate shear wall buildings. Twelve neural networks have been developed using 6,48,000 patterns for the prediction of site-specific dynamic to static eccentricity ratio. The performance of the neural networks has been validated for a number of example torsionally coupled framed buildings. Again the weights and biases of the trained networks and a user friendly program have been given for use in every day design. The applicability of neural network models developed has been demonstrated for a torsionally uncoupled and a torsionally coupled high rise shear wall building also.

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