IJG> Vol.3 No.3, July 2012

OPEN ACCESS

Neural Network Approach to Response of Buildings Due to Earthquake Excitation

PDF (Size:1503KB) PP. 630-639 DOI: 10.4236/ijg.2012.33063

Author(s)

Sayantan Chakraborty, Prashant Kumar, Swapan Kumar Chakraborty

ABSTRACT

The present article investigates the physical phenomena associated with the wave passage effect into a building considering the ground floor as the soft floor with the conformity of the up-to-date scenario of the construction of high rise buildings, due to shear excitation of the base. The aim of the study is to analyse the post-earthquake situation of the building in respect to its health. With this vision, the ensuing problem on two-dimensional building models, non-incorporating soil-structure interaction, is being tackled by both analytical and neural network approaches. Computational results from both ends (of the approaches) show that the wave energy does not always propagate from the ground into the building, but for lower frequency range it sails to the building without any disturbances. However, for higher frequency range, the computational results show that the building experiences large "torsional" deformations, as a result the building may collapse. Finally, both the approaches maintain a good agreement among themselves. The present investigation may lead to a long way in contributing to better and more rational, simplified design criteria.

KEYWORDS

Neural Network; Anisotropic Building; Soft Ground Floor

Cite this paper

S. Chakraborty, P. Kumar and S. Chakraborty, "Neural Network Approach to Response of Buildings Due to Earthquake Excitation," *International Journal of Geosciences*, Vol. 3 No. 3, 2012, pp. 630-639. doi: 10.4236/ijg.2012.33063.

References

[1] V. A. Krivelev, Ed., "Volnovie protcessi V. Konstrukeiah, Zdanii pri Seizmitchaskiih Vozdeistviah," Nauka, Soviet Academy of Sciences, Moscow, 1987.

[2] S. Kojic, M. D. Trifunac and J. C. Anderson, "A Post-Earthquake Response Analysis of the Imperial County Services Building in EI Centro," Report No. CE-84-02, Department of Civil Engineering, University of Southern California, Los Angles, 1984.

[3] I. D. Gupta and M. D. Trifunac, "Order Statistics in Earthquake Response of Multi-Degree-of-Freedom Systems," Earthquake Engineering and. Engineering Vibration, Vol. 7, No. 4, 1987, pp. 15-50.

[4] I. D. Gupta and M. D. Trifunac, "Order Statistics of Peaks of Response of Multicomponent Seismic Excitation," Bulletin of the Indian Society of Earthquake Technology, Vol. 24, No. 3, 1987, pp. 135-139.

[5] I. D. Gupta and M. D. Trifunac, "Order Statistics of Peaks in Earthquake Response," Journal of Engineering Mechanics, Vol. 114, No. 10, 1988, pp. 1605-1627.doi:10.1061/(ASCE)0733-9399(1988)114:10(1605)

[6] I. D. Gupta and M. D. Trifunac, "A Note on Contribution of Rocking Excitation to Earthquake Response of Simple Building," Bulletin of the Indian Society of Earthquake Technology, Vol. 25, No. 2, 1988, pp. 73-89.

• Open Special Issues
• Published Special Issues
• Special Issues Guideline

IJG Subscription

Most popular papers in IJG

About IJG News

Frequently Asked Questions

Recommend to Peers

Recommend to Library

Contact Us

[7] S. Kojic, M. D. Trifunac and V. W. Lee, "Earthquake Response of Arch Dams to Non-Uniform Canyon Motion," Report No. CE 84-02, University of Southern California, Los Angles, 1988.

[8] I. D. Gupta and M. D. Trifunac, "A Note on Contribution of Torsional Excitation to Earthquake Response of Simple Symmetric Buildings," Earthquake Engineering and Engineering Vibration, Vol. 7, No. 3, 1987, pp. 27-46.

[9] A. M. Chandler, N. T. K. Lam and H. H. Tsang, "Shear Wave Velocity Modeling in Crustal Rock for Seismic Hazard Analysis," Soil Dynamics and Earthquake Engineering, Vol. 25, No. 2, 2005, pp. 167-185.doi:10.1016/j.soildyn.2004.08.005

[10] A. K. Chopra, D. P. Clough and R. W. Clough, "Earthquake Resistance of Buildings with a Soft First Storey," Earthquake Engineering & Structural Dynamics, Vol. 1, No. 4, 1973, pp. 347-355. doi:10.1002/eqe.4290010405

[11] D. M. Lee and I. C. Medland, "Base Isolation Systems for Earthquake Protection of Multi-storey Shear Structures," Earthquake Engineering & Structural Dynamics, Vol. 7, No. 6, 1979, pp. 555-568. doi:10.1002/eqe.4290070605

[12] R. I. Skinner, J. L. Beck and G. N. Bycroft, "A Practical System for Isolating Structures From Earthquake Attack," Earthquake Engineering & Structural Dynamics, Vol. 3, 1975, pp. 297-309. doi:10.1002/eqe.4290030308

[13] S. D. Werner, et al., "An Evaluation of the Effects of Travelling Seismic Waves on the Three-Dimensional Response of Structures," Report No. R7720-4514, Agbabian Associates, El Segundo, 1977.

[14] I. Kashefi and M. D. Trifunac, "Investigation of Earthquake Response of Simple Bridge Structures," Report No. CE86-02, University of Southern California, Los Angles, 1986.

[15] L. Tzenov and H. Boncheva, "Digiv Plan Sgardi s Ogled Sezimichnoto in Osiguriavanic," Bulgarian Academy of Sciences, Bulgarian Geophysical Journal, Vol. 4, 1979, pp. 61-67.

[16] L. Tzenov, "Vliane na Dlzinata na Knostruktsiite vrhu Natovaranic," Bulgarian Academy of Sciences, Journal of Theoretical and Applied Mechanics, Vol. 17, 1981, pp. 97-105.

[17] M. I. Todorovska, V. W. Lee and M. D. Trifunac, "Investigation of Earthquake Response of Long Buildings," Report No. CE-88-02, University of Southern California, Ls Angles, 1988.

[18] M. I. Todorovska and M. D. Trifunac, "Antiplane Earthquake Waves in Long Structures," Journal of Engineering Mechanics, Vol. 15, No. 12, 1989, pp. 2687-2708.doi:10.1061/(ASCE)0733-9399(1989)115:12(2687)

[19] M. I. Todorovska and V. W. Lee, "Seismic Waves in Buildings with Shear Walls or Central Core," Journal of Engineering Mechanics, Vol. 15, No. 12, 1989, pp. 2669- 2686. doi:10.1061/(ASCE)0733-9399(1989)115:12(2669)

[20] M. I. Todorovska and M. D. Trifunac, "A Note on Excitation of Long Structures by Ground Waves," Journal of Engineering Mechanics, Vol. 116, No. 4, 1990, pp. 952- 964. doi:10.1061/(ASCE)0733-9399(1990)116:4(952)

[21] J. F. Hall, T. H. Heaton, M. W. Halling and D. J. Wald, "Near Source Ground Motion and Its Effects on Flexible Buildings," Earthquake Spectra, Vol. 11, No. 4, 1995, pp. 569-605. doi:10.1193/1.1585828

[22] M. W. Halling and J. F. Hall, "Analysis of Base-Isolated Structures Utilizing Near-Source Strong Ground Motions," Proceedings of the Structures Congress, Reston, 1997, pp. 1123-1127.

[23] J. P. Wolf and P. Obernhuber, "Effects of Horizontally Propagating Waves on the Response of Structures with a Soft First Storey," Earthquake Engineering & Structural Dynamics, Vol. 9, No. 1, 1981, pp.1-21.doi:10.1002/eqe.4290090102

[24] S. K. Chakraborty, S. K. Sarkar and S. P. Bhattacharya, "Frequency-Response Analysis of Shear Vibration of Long Structures Due to Surface Excitation," International Journal of Acoustics and Vibration, Vol. 12, No. 3, 2007, pp. 109-115.

[25] S. K. Chakraborty and S. K. Sarkar, "Response Analysis of Multi-Storey Structures on Flexible Foundation Due to Seismic Excitation," International Journal of Acoustics and Vibration, Vol. 13, No. 4, 2008, pp. 165-170.

[26] X. Wu, J. Ghaboussi and J. H. Garrett, "Use of Neural Networks in Detection of Structural Damage,"

Computers and Structures, Vol. 42, No. 4, 1992, pp. 649-659.doi:10.1016/0045-7949(92)90132-J

[27] M. F. Elkordy, K. C. Chang and G. C. Lee, "Neural Networks Trained by Analytically Simulated Damage States," Journal of Computing in Civil Engineering, Vol. 7, No. 2, 1993, pp. 130-145.doi:10.1061/(ASCE)0887-3801(1993)7:2(130)

[28] P. C. Pandey and S. V. Barai, "Multilayer Perceptron in Damage Detection of Bridge Structures,"