

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/361881347>

Simulation of Spatially Variable Artificial Earthquake: A Case Study of Different Site Conditions

Article in *Modelling in Civil Environmental Engineering* · July 2022

DOI: 10.2478/mcee-2021-0017

CITATIONS

0

READS

81

3 authors, including:



Rachid Derbal

University of Ain Temouchent

15 PUBLICATIONS 23 CITATIONS

[SEE PROFILE](#)

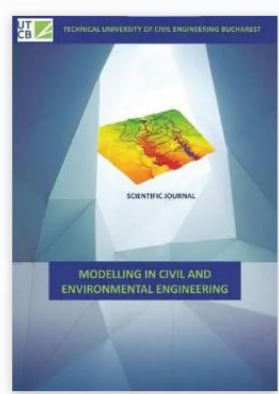


Nassima Benmansour

About Bakr Belkaid University of Tlemcen

17 PUBLICATIONS 26 CITATIONS

[SEE PROFILE](#)



Modelling in Civil
Environmental Engineering

Journal Details



Open Access

Simulation of Spatially Variable Artificial Earthquake: A Case Study of Different Site Conditions

[Rachid Derbal](#), [Nassima Benmansour](#) and [Mustapha Djafour](#)

Published Online: 09 Jul 2022
Volume & Issue: Volume 16 (2021) - Issue 4 (December 2021)
Page range: 13 - 24

DOI: <https://doi.org/10.2478/mcee-2021-0017>

© 2022 Rachid Derbal et al., published by Sciencdo
This work is licensed under the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License.

Download
 Cite
 Share
 Previous
 Next →

REFERENCES

[1] Der Kiureghian, A. (1996). A coherency model for spatially varying ground motions. *Earthquake Engineering and Structural Dynamics*, 25(1), 99–111. DOI: 10.1002/(sici)1096-9845(199601)25:1<99::aideqe540>3.3.co;2-3. [Open DOI Search in Google Scholar](#)

[2] Konakli, K. & Der Kiureghian A. (2012). Simulation of spatially varying ground motions including incoherence, wave-passage and differential site-response effects. *Earthquake Engineering & Structural Dynamics*, 41(3), 495–513. DOI: 10.1002/eqe.1141. [Open DOI Search in Google Scholar](#)

[3] Harichandran, RS. (1999). Spatial Variation of Earthquake Ground Motion - What is it, how do we model it, and what are its engineering implications ?, Manuscript corresponding to seminars presented at University of Puerto Rico. [Search in Google Scholar](#)

[4] Zerva, A. Spatial variation of seismic ground motions: modeling and engineering applications. CRC Press. DOI: 10.1201/9781420009910. [Open DOI Search in Google Scholar](#)

[5] Abrahamson, N. (2008). Ground Motion Models. *Geotechnical Earthquake Engineering and Soil Dynamics IV*, Reston, VA: American Society of Civil Engineers. DOI: 10.1061/40975(318)2. [Open DOI Search in Google Scholar](#)

- [6] Zendagui, D. Berrah, MK. & Kausel E. (1999). Stochastic deamplification of spatially varying seismic motions. *Soil Dynamics and Earthquake Engineering*, 18(6), 409–421. DOI: 10.1016/S0267-7261(99)00015-9. [Open DOI Search in Google Scholar](#)
- [7] Zendagui, D. & Berrah MK. (2002). Spatial variation of seismic motion induced by propagation of body waves. *Soil Dynamics and Earthquake Engineering*, 22(9–12), 805–811. DOI: 10.1016/S0267-7261(02)00102-1. [Open DOI Search in Google Scholar](#)
- [8] Zerva, A. & Shinozuka M. (1991). Stochastic differential ground motion. *Structural Safety*, 10(1–3), 129–143. DOI: 10.1016/0167-4730(91)90010-7. [Open DOI Search in Google Scholar](#)
- [9] Zerva, A. (1992). Seismic loads predicted by spatial variability models. *Structural Safety*, 11(3–4), 227–243. DOI: 10.1016/0167-4730(92)90016-G. [Open DOI Search in Google Scholar](#)
- [10] Harichandran, RS. & Vanmarcke EH. (1986). Stochastic variation of earthquake ground motion in space and time. *Journal of Engineering Mechanics*, 112(2), 154–174. DOI: 10.1061/(asce)0733-9399(1986)112:2(154). [Open DOI Search in Google Scholar](#)
- [11] Bi, K. Hao H. & Ren W. (2010). Response of a frame structure on a canyon site to spatially varying ground motions. *Structural Engineering and Mechanics*, 36(1), 111–127. DOI: 10.12989/sem.2010.36.1.111. [Open DOI Search in Google Scholar](#)
- [12] Derbal, R. Benmansour, N. Djafour, M. Matallah M. & Ivorra S. (2019). Viaduct seismic response under spatial variable ground motion considering site conditions. *Earthquake and Structures*, 17(6), 557–566. DOI: 10.12989/eas.2019.17.6.557. [Open DOI Search in Google Scholar](#)
- [13] Derbal, R. Benmansour, N. Djafour, M. Matallah M. & Ivorra S. (2021). Sensitivity of spatial variable seismic ground motion to multiple local site conditions. 9th Turkish Conference on Earthquake Engineering (9TCEE), 2-3 June 2021 (pp. 434-441). Istanbul, Turkey. [Search in Google Scholar](#)
- [14] Sextos, A. Karakostas, C. Lekidis V. & Papadopoulos S. (2015). Multiple support seismic excitation of the Evripos bridge based on free-field and on-structure recordings. *Structure and Infrastructure Engineering*, 11(11). DOI: 10.1080/15732479.2014.977302. [Open DOI Search in Google Scholar](#)
- [15] Zerva, A. & Stephenson WR. (2011). Stochastic characteristics of seismic excitations at a non-uniform (rock and soil) site. *Soil Dynamics and Earthquake Engineering*, 31(9), 1261–1284. DOI: 10.1016/j.soildyn.2011.05.006. [Open DOI Search in Google Scholar](#)
- [16] Fontara, IK. Titirla, MD. Wuttke, F. Athanatopoulou, AM. Manolis GD. & Sextos AG. (2015). Multiple support excitation of a bridge based on a BEM analysis of the subsoil-structure interaction phenomenon. COMPDYN 2015 and 5th ECCOMAS Thematic Conference on Computational Methods in Structural Dynamics and Earthquake Engineering At: Crete Island, Greece. [Search in Google Scholar](#)

- [17] Bard, P.Y. Campillo, M. Chavez-Garcia F.J. & Sanchez-Sesma F. (1988). Mexico earthquake of September 19, 1985 - a theoretical investigation of large- and small-scale amplification effects in the Mexico City valley. *Earthquake Spectra*, 4(3), 609–633. DOI: 10.1193/1.1585493.[Open DOI Search in Google Scholar](#)
- [18] Wang, S. & Hao H. (2002). Effects of random variations of soil properties on site amplification of seismic ground motions. *Soil Dynamics and Earthquake Engineering*, 22(7), 551–564. DOI: 10.1016/S0267-7261(02)00038-6.[Open DOI Search in Google Scholar](#)
- [19] Bi, K. & Hao H. (2012). Modelling and simulation of spatially varying earthquake ground motions at sites with varying conditions. *Probabilistic Engineering Mechanics*, 29, 92–104. DOI: 10.1016/j.probengmech.2011.09.002.[Open DOI Search in Google Scholar](#)
- [20] Zhang, D.Y. Liu, W. Xie W.C. & Pandey M.D. (2013). Modeling of spatially correlated, site-reflected, and nonstationary ground motions compatible with response spectrum. *Soil Dynamics and Earthquake Engineering*, 55, 21–32. DOI: 10.1016/j.soildyn.2013.08.002.[Open DOI Search in Google Scholar](#)
- [21] Derbal, R. Benmansour N. & Djafour M. (2018). Impact of spatial variability of earthquake ground motion on seismic response of a railway bridge. *International Journal of Computational Methods and Experimental Measurements*, 6(3), 910–920. DOI: 10.2495/cmeme-v6-n5-910-920.[Open DOI Search in Google Scholar](#)
- [22] Adanur, S. Altunişik, A.C. Soyluk, K. Bayraktar A. & Dumanoğlu AA. (2016). Multiple-support seismic response of Bosphorus Suspension Bridge for various random vibration methods. *Case Studies in Structural Engineering*, 5, 54–67. DOI: 10.1016/j.csse.2016.04.001.[Open DOI Search in Google Scholar](#)
- [23] Li, C. Li, H. Hao, H. Bi K. & Tian L. (2018). Simulation of multi-support depth-varying earthquake ground motions within heterogeneous onshore and offshore sites. *Earthq Eng & Eng Vib*, 17(3), 475–490. DOI: 10.1007/s11803-018-0456-7.[Open DOI Search in Google Scholar](#)
- [24] Shiravand, M.R. & Parvanehro P. (2019). Spatial variation of seismic ground motion effects on nonlinear responses of cable stayed bridges considering different soil types. *Soil Dynamics and Earthquake Engineering*, 119, 104–117. DOI: 10.1016/j.soildyn.2019.01.002.[Open DOI Search in Google Scholar](#)
- [25] Boudina, A. & Hammoutene M. (2020). Generation of seismic excitations compatible with target spectrum: application to Eurocode 8. *World Journal of Engineering*, 18(1), 122–135. DOI: 10.1108/WJE-02-2020-0042.[Open DOI Search in Google Scholar](#)
- [26] Liu, G. Liu, Y. Han B. & Lian J. (2020). Theoretical and numerical approach for simulating spatially variable seismic underground motions in layered saturated media. *Journal of Earthquake Engineering*, 24(4), 601–627. DOI: 10.1080/13632469.2018.1452809.[Open DOI Search in Google Scholar](#)

- [27] Loyola, L. Rojas F. & Ruiz RO. (2021). Synthetic stochastic ground motions compatible with the Chilean seismic hazard. *Engineering Structures*, 228. DOI: 10.1016/j.engstruct.2020.111471. [Open DOI Search in Google Scholar](#)
- [28] Muscolino, G. Genovese, F. Biondi G. & Cascone E. (2021). Generation of fully non-stationary random processes consistent with target seismic accelerograms. *Soil Dynamics and Earthquake Engineering*, 141: 106467. DOI: 10.1016/J.SOILDYN.2020.106467. [Open DOI Search in Google Scholar](#)
- [29] Rodda, GK. & Basu D. (2018). Spatial variation and conditional simulation of seismic ground motion. *Bulletin of Earthquake Engineering*, 16(10), 4399–4426. DOI: 10.1007/s10518-018-0397-6. [Open DOI Search in Google Scholar](#)
- [30] Rodda, GK. & Basu D. (2020). Spatially correlated vertical ground motion for seismic design. *Engineering Structures*, 206, 110191. DOI: 10.1016/j.engstruct.2020.110191. [Open DOI Search in Google Scholar](#)
- [31] Benmansour, N. (2013). Effet de la variabilité spatiale du mouvement sismique sur le comportement dynamique des ponts. University of Tlemcen – Aboubakr Belkaid, Tlemcen, Algeria. [Search in Google Scholar](#)
- [32] Benmansour, N. Djafour, M. Bekkouche, A. Zendagui D. & Benyacoub A. (2012). Seismic response evaluation of bridges under differential ground motion: A comparison with the new Algerian provisions. *European Journal of Environmental and Civil Engineering*, 16(7), 863–881. DOI: 10.1080/19648189.2012.681951. [Open DOI Search in Google Scholar](#)
- [33] Wolf, JP. (1985). *Dynamic Soil-Structure Interaction*. [Search in Google Scholar](#)
- [34] Şafak, E. (1995). Discrete-Time Analysis of Seismic Site Amplification. *Journal of Engineering Mechanics*, 121(7), 801–809. DOI: 10.1061/(asce)0733-9399(1995)121:7(801). [Open DOI Search in Google Scholar](#)
- [35] Deodatis, G. (1996). Non-stationary stochastic vector processes: Seismic ground motion applications. *Probabilistic Engineering Mechanics*, 11(3), 149–167. DOI: 10.1016/0266-8920(96)00007-0. [Open DOI Search in Google Scholar](#)
- [36] Bi, K. & Hao H. (2012). Influence of ground motion spatial variations and local soil conditions on the seismic responses of buried segmented pipelines. *Structural Engineering and Mechanics*, 44, 663-680. DOI: 10.12989/sem.2012.44.5.663. [Open DOI Search in Google Scholar](#)
- [37] Jennings, PC. Housner GW. & Tsai NC. (1968). Simulated earthquake motions. A report on research conducted under a grant from the National Science Foundation, Pasadena, California, USA. [Search in Google Scholar](#)
- [38] Clough, RW. & Penzien J. (1993). *Dynamics of structures*. 2nd edition. New York: mcgraw-Hill. [Search in Google Scholar](#)

[39] Tajimi, HA. (1960). Statistical method of determining the maximum response of a building structure during an earthquake. In: Proceedings of the second world conference Engineering E, editor., Tokyo and Kyoto, Japan, 1960.[Search in Google Scholar](#)

[40] MTP, (2010). Règles parasismiques applicables au domaine des ouvrages d'art. Ministère des Travaux Publics, Alger.[Search in Google Scholar](#)

[41] CEN, (2004). Eurocode 8: Design provisions of structures for earthquake resistance-part1: General rules, Seismic Actions and Rules for buildings, EN1998-1:2004. Brussels, Belgium.[Search in Google Scholar](#)

[42] Li, C. Hao, H. Li, H. Bi K. & Chen B. (2017). Modeling and simulation of spatially correlated ground motions at multiple onshore and offshore sites. Journal of Earthquake Engineering, 21(3), 359-383.
DOI: 10.1080/13632469.2016.1172375.[Open DOI Search in Google Scholar](#)