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Damping Estimation of Friction Systems in Random Vibrations

Friction is one of the most efficient and economical mechanisms to reduce vibrations in structural mechanics. However, the estimation of the equivalent linear damping of the friction damped systems in experimental modal analysis and operational modal analysis can be adversely affected by several assumptions regarding the definition of the linear damping and the identification methods or may be lacking a meaningful interpretation of the damping. Along these lines, this project focuses on assessing the potential to estimate efficiently the equivalent linear damping of friction systems in random vibrations with the use of one novel method and two existing ones, modified, though, appropriately. Results of numerical simulations using the three procedures enabled their preliminary comparative assessment in terms of the related damping estimation potential. Indications from the current study showed that two of the methods estimate efficiently the equivalent linear damping, however, the equivalent linear damping seems to depend on the definition of the equivalence. Nonetheless, it seems that the variation of the equivalent linear damping estimates based on the three aforementioned methods becomes less significant when compared to their actual influence on the linear response.

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Digital archive for strong ground motions recorded in earthquake sequences

General information
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Contributors: Katsanos, E., Boserup, V. A.
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Effect of Friction-Induced Nonlinearity on OMA-Identified Dynamic Characteristics of Offshore Platform Models
The identification of the modal characteristics of engineering systems under operational conditions is commonly conducted with the use of the Operational Modal Analysis (OMA), being a class of useful tools employed within various fields of structural, mechanical as well as marine and naval engineering. The current OMA methods have been advanced on the basis of two fundamental, though, restrictive assumptions: (i) linearity and (ii) stationarity. Nevertheless, there are several applications that are inherently related to various nonlinear mechanisms, which, in turn, violate the two cornerstones of OMA and hence, question its robustness and efficiency. Along these lines, the current study addresses the effect of friction-induced nonlinearity on OMA-identified dynamic characteristics of an experimental set up consisting of a pair of reduced scale offshore platform models that are connected through a friction-based mechanism. Both time-domain and frequency-domain methods were employed to assess the effect of the varying friction-induced nonlinearity on the OMA-identified modal characteristics. The findings of this study reveal that OMA-based methods provide reasonable identification results implying that nonlinear and nonstationary systems can be described by underlying linear systems, even though, in principles, the basic assumptions of linearity and stationarity are violated.

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IDA-based definition of damage states for rc silo subjected to seismic excitations
Extensive damages or collapse observed for silos subjected to earthquake excitations can lead to significant monetary and environmental losses while human life may also be set at high risk. Therefore, the design of earthquake-resistant silos is essential to safeguard silos’ integrity and functionality over their lifetime. In case of adopting the performance-based design approach, well-defined damage limit states are required to quantify the expected seismic failures of silos. Nevertheless, to the authors’ best knowledge, only marginal research effort has been already spent to quantify appropriate damage limit states for silos. To this end, the current study is dedicated to determine damage states for a typical cylindrical reinforced concrete silo, containing granular material with the use of a multi-record, non-linear incremental dynamic analysis (IDA). The numerical model of the silo was developed in ABAQUS. The advanced hypoplastic constitutive model, extended with the intergranular strain approach, was adopted to simulate the dynamic performance of the granular material while the silo wall was modelled by using the concrete damaged plasticity model. Additionally, granular material-structure interaction was considered through a Coulomb friction interface. Both static and dynamic (i.e., time history) analyses were performed to validate both the granular material-structure interaction and the silo’s dynamic response. Furthermore, IDA curves, in terms of base shear over top displacement, were calculated with the use of an appropriately selected and scaled set of earthquake strong ground motions. The IDA curves were eventually used to quantify five damage limit states according to maximum top displacement criterion.

General information
Influence of diaphragm modelling on the dynamic performance of a reinforced concrete high-rise building

General information
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Organisations: Department of Civil Engineering, Structures and Safety
Contributors: Savnik, N., Katsanos, E., D.R.Amador, S., Ventura, C., Brincker, R.
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Nonlinear Strain Estimation Based on Linear Parameters
This paper aims to demonstrate how to estimate strains of fixed structures considering cases with nonlinearities based on parameters determined from one linear case. Both simulated and experimental data have been evaluated. A finite element model was used to obtain the simulated responses. Accelerations and strains were measured along the application of random loading to a fixed structural model for the experimental data. Operational Modal Analysis has been considered in the time domain in order to identify the modal properties. Nonlinearities are included as friction is imposed on the models.

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Organisations: Structures and Safety, Department of Civil Engineering, Aarhus University
Contributors: Nabuco, B., Friis, T., Tarpø, M., Amador, S., Katsanos, E. I., Brincker, R.
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Operational Modal Analysis based Stress Estimation in Friction Systems
It is possible to estimate the strain response of a structure in unmeasured points by the use of operational modal analysis and modal expansion. Both techniques are based on the assumption that the system is linear. However, this is not always the case since nonlinear elements often violate this assumption. In this paper, the precision of estimating the strain response of a nonlinear system is investigated using the operational response of numerical simulations. Local nonlinearities are introduced by adding friction to the test specimen and this paper finds that this approach of strain estimation can still predict the strains with high precision.

General information
Output-only damping estimation of friction systems in ambient vibrations

Working with dynamics in civil engineering applications, it is experienced that real structures have nonlinear damping. The nonlinearity of the damping can be induced by the hysteresis phenomenon, that occurs due to friction or softening geotechnical boundary conditions. Along these lines, this article focusses on assessing the performance of two output-only methods estimating the linear damping of a friction-induced nonlinearly damped system subjected to random vibrations. In particular, the method that employs auto regressive models and poly-reference, and the poly-reference Least Squares Complex Frequency method are included in the study. The methods are comparatively assessed by comparing their linear damping estimates of friction-induced nonlinear numerical simulations with theoretically derived estimates of equivalent linear damping. It is concluded that the output-only methods underestimate the damping when compared to theoretically derived equivalent linear damping for the present case of Coulomb-type friction-induced nonlinear damping.

Residual displacement ratios of SDOF systems subjected to ground motions recorded on soft soils

120 earthquake ground motions recorded on soft soil sites were employed to assess, through response history analysis of simplified systems, the residual displacement demand, $C_r$, defined as the ratio of the residual displacement to the maximum elastic displacement. Single degree of freedom systems were considered and the lateral strength ratio was parametrized to account for varying structural inelasticity. Four hysteretic laws were chosen to represent degrading and non-degrading performance while variation in the post-yield stiffness was considered. The analysis scheme enabled assessing the relationship of the residual displacement with the aforementioned structural characteristics. The residual displacement demand was found to be sensitive in the post-yield stiffness ratio. An equation was finally introduced to accommodate the reliable estimation of residual displacement ratio, the latter being beneficial for evaluating the seismic performance of existing structures built on soft soil sites.
Structural Integrity Management with Unmanned Aerial Vehicles: State-of-the-Art Review and Outlook

Over the last decade, Unmanned Aerial Vehicles (UAVs) have been used for monitoring construction and operation of civil infrastructure, as well as industrial facilities and power plants. Their operational simplicity along with time-and-cost-related benefits have already rendered them attractive for structural surveying. Nevertheless, the field of UAV research currently lacks a targeted employment of UAVs for Structural Integrity Management (SIM) and Structural Health Monitoring (SHM). This paper provides an overview about actual developments of UAV technologies, breakthroughs in sensor technologies, SHM and Value of Information analysis, the latter being oriented to facilitate an efficiency assessment of precision and cost dependent information. Relevant literature, as well as research and industrial projects, integrating UAVs and SHM are described and assessed, while monitoring strategies, advanced technologies and related algorithms are discussed with a view to achieving increased Value of UAV-based SHM Information.

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Organisations: Department of Civil Engineering, Design and Processes, Structures and Safety, Aalborg University, SNC-Lavalin Group
Contributors: Kapoor, M., Katsanos, E., Thöns, S., Nalpantidis, L., Winkler, J.
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Structure-specific selection of earthquake ground motions for the reliable design and assessment of structures

A decision support process is presented to accommodate selecting and scaling of earthquake motions as required for the time domain analysis of structures. Code-compatible suites of seismic motions are provided being, at the same time, prequalified through a multi-criterion approach to induce response parameters with reduced variability. The latter is imperative to increase the reliability of the average response values, normally required for the code-prescribed design verification of structures. Structural attributes like the dynamic characteristics as well as criteria related to variability of seismic motions and their compliance with a target spectrum are quantified through a newly introduced index \(\delta_{sv-sc}\), which aims to prioritize motions suites for response history analysis. To demonstrate the applicability of the procedure presented, the structural model of a multi-story building was subjected to numerous suites of motions that were highly ranked according to both the proposed approach \(\delta_{sv-sc}\) and the conventional one \(\delta_{conv}\), that is commonly used for earthquake records selection and scaling. The findings from numerous linear response history analyses reveal the superiority of the proposed multi-criterion approach, as it extensively reduces the intra-suite structural response variability and consequently, increases the reliability of the design values. The relation between the target reliability in assessing structural response and the size of the suite of motions selected was also investigated, further demonstrating the efficiency of the proposed selection procedure to achieve higher response reliability levels with smaller samples of ground motion.

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Web of Science (2017): Impact factor 2.303
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BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.12 SJR 1.335 SNIP 1.35
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BFI (2015): BFI-level 2
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BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 1.97 SJR 1.471 SNIP 1.813
Web of Science (2014): Impact factor 1.884
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.04 SJR 1.216 SNIP 1.653
Web of Science (2013): Impact factor 1.368
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Scopus rating (2012): CiteScore 1.55 SJR 1.283 SNIP 1.648
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BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.63 SJR 1.047 SNIP 1.377
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Scopus rating (2010): SJR 1.467 SNIP 1.137
Web of Science (2010): Impact factor 1.701
Scopus rating (2009): SJR 1.146 SNIP 1.001
Scopus rating (2008): SJR 2.155 SNIP 1.939
Scopus rating (2007): SJR 0.969 SNIP 1.262
Scopus rating (2006): SJR 1.578 SNIP 1.174
Scopus rating (2005): SJR 1.106 SNIP 0.685
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Moving on dangerous grounds – wind power and earthquake exposures in China

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Multi-hazard response analysis of a 5MW offshore wind turbine

Wind energy has already dominant role on the scene of the clean energy production. Well-promising markets, like China, India, Korea and Latin America are the fields of expansion for new wind turbines mainly installed in offshore environment, where wind, wave and earthquake loads threat the structural integrity and reliability of these energy infrastructures. Along these lines, a multi-hazard environment was considered herein and the structural performance of a 5 MW offshore wind turbine was assessed through time domain analysis. A fully integrated model of the offshore structure consisting of the blades, the nacelle, the tower and the monopile was developed with the use of an aeroelastic code considering the interaction between the elastic and inertial forces, developed in the structure, as well as the generated aerodynamic and hydrodynamic forces. Based on the analysis results, the dynamic response of the turbine’s tower was found to be severely affected by the earthquake excitations. Moreover, fragility analysis based on acceleration capacity thresholds for the nacelle’s equipment corroborated that the earthquake excitations may adversely affect the reliability and availability of wind turbines.

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Organisations: Department of Civil Engineering, Section for Structural Engineering, COWI AS, Aarhus University
Contributors: Katsanos, E., Sanz, A. A., Georgakis, C. T., Thöns, S.
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Scopus rating (2015): CiteScore 0.56
Scopus rating (2014): CiteScore 0.53
Scopus rating (2013): CiteScore 0.4
ISI indexed (2013): ISI indexed no
Scopus rating (2012): CiteScore 0.28
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Scopus rating (2011): CiteScore 0.45
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Web of Science (2010): Indexed yes
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Robust identification

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Structural Monitoring for Offshore Structures: A challenge needs to be undertaken

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Contributors: Katsanos, E., Diord Rescino Amador, S., Brincker, R.
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Yield Frequency Spectra and seismic design of code-compatible RC structures: an illustrative example
The seismic design of an 8-story reinforced concrete space frame building is undertaken using a Yield Frequency Spectra (YFS) performance-based approach. YFS offer a visual representation of the entire range of a system's performance in terms of the mean annual frequency (MAF) of exceeding arbitrary global ductility or displacement levels versus the base shear strength. As such, the YFS framework can establish the required base shear and corresponding first-mode period to satisfy arbitrary performance objectives for any structure that may be approximated by a single-degree-of-freedom system with given yield displacement and capacity curve shape. For the 8-story case study building, deformation checking is the governing limit state. A conventional code-based design was performed using seismic intensities tied to the desired MAF for safety checking. Then, the YFS-based approach was employed to redesign the resulting structure working backwards from the desired MAF of response (rather than intensity) to estimate an appropriate value of seismic intensity for use within a typical engineering design process. For this high-seismicity and high-importance midrise building, a stiffer system with higher base shear strength was thus derived. Moreover, performance assessment via incremental dynamic analysis showed that while the code-design did not meet the required performance objective, the YFS-based redesign needed only pushover analysis results to offer a near-optimal design outcome. The rapid convergence of the method in a single design/analysis iteration emphasized its efficiency and practicability as a design aid for practical application.

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Web of Science (2017): Impact factor 2.807
Web of Science (2017): Indexed yes
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Scopus rating (2016): CiteScore 2.91 SJR 2.244 SNIP 2.237
Web of Science (2016): Impact factor 1.974
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 3.08 SJR 2.681 SNIP 2.741
Web of Science (2015): Impact factor 2.127
Reliable selection of earthquake ground motions for performance-based design

A decision support process is presented to accommodate selecting and scaling of earthquake motions as required for the time domain analysis of structures. Prequalified code-compatible suites of seismic motions are provided through a multi-criterion approach to satisfy prescribed reduced variability of selected Engineering Demand Parameters. Such a procedure, even though typically overlooked, is imperative to increase the reliability of the average response values, as required for the code-prescribed design verification of structures. Structure-related attributes such as the dynamic characteristics, as well as criteria related to the seismic motions variability and their compliance with a target spectrum are quantified through a newly introduced index, $\delta_{sv-sc}$, tailored to prioritize motions suites for the response history analysis. An actual multi-story building is used to demonstrate the efficiency of the method, by being subjected to numerous suites.
of motions that were highly ranked according to both the proposed approach (δsv-sc) and the conventional index (δconv), already used by most existing code-based earthquake records selection and scaling procedures. The findings reveal the superiority of the herein proposed multi-criterion approach, particularly in terms of extensively reducing the intra-suite response variability of ground motions, while at the same time increasing the reliability of the design values. They also demonstrate that the new index greatly reduces the size of the suite of selected ground motions, for a given level of target reliability, with respect to the conventional methods.

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Wind turbines and seismic hazard: a state-of-the-art review
Wind energy is a rapidly growing field of renewable energy, and as such, intensive scientific and societal interest has been already attracted. Research on wind turbine structures has been mostly focused on the structural analysis, design and/or assessment of wind turbines mainly against normal (environmental) exposures while, so far, only marginal attention has been spent on considering extreme natural hazards that threat the reliability of the lifetime-oriented wind turbine’s performance, Especially, recent installations of numerous wind turbines in earthquake prone areas worldwide (e.g., China, USA, India, Southern Europe and East Asia) highlight the necessity for thorough consideration of the seismic implications on these energy harnessing systems. Along these lines, this state-of-the-art paper presents a comparative survey of the published research relevant to the seismic analysis, design and assessment of wind turbines. Based on numerical simulation, either deterministic or probabilistic approaches are reviewed, because they have been adopted to investigate the sensitivity of wind turbines’ structural capacity and reliability in earthquake-induced loading. The relevance of seismic hazard for wind turbines is further enlightened by available experimental studies, being also comprehensively reported through this paper. The main contribution of the study presented herein is to identify the key factors for wind turbines’ seismic performance, while important milestones for ongoing and future advancement are emphasized.

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Contributors: Katsanos, E., Thöns, S., Georgakis, C. T.
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.18 SJR 1.051 SNIP 1.834
Web of Science (2017): Impact factor 2.938
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.37 SJR 1.079 SNIP 2.316
A case-study in performance-based design using yield frequency spectra

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Organisations: Department of Civil Engineering, Section for Structural Engineering
Contributors: Vamvatsikos, D., Katsanos, E., Aschheim, M.
Publication date: 2015

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Inelastic spectra to predict period elongation of structures under earthquake loading

Period lengthening, exhibited by structures when subjected to strong ground motions, constitutes an implicit proxy of structural inelasticity and associated damage. However, the reliable prediction of the inelastic period is tedious and a multi-parametric task, which is related to both epistemic and aleatory uncertainty. Along these lines, the objective of this paper is to investigate and quantify the elongated fundamental period of reinforced concrete structures using inelastic response spectra defined on the basis of the period shift ratio ($T_{in}/T_{el}$). Nonlinear oscillators of varying yield strength (expressed by the force reduction factor, $R_y$), post-yield stiffness ($a_y$) and hysteretic laws are examined for a large number of strong motions. Constant-strength, inelastic spectra in terms of $T_{in}/T_{el}$ are calculated to assess the extent of period elongation for various levels of structural inelasticity. Moreover, the influence that structural characteristics ($R_y$, $a_y$ and degrading level) and strong-motion parameters (epicentral distance, frequency content and duration) exert on period lengthening are studied. Determined by regression analyses of the data obtained, simplified equations are proposed for period lengthening as a function of $R_y$ and $T_{el}$. These equations may be used in the framework of the earthquake record selection and scaling.

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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.91 SJR 2.244 SNIP 2.237
Web of Science (2016): Impact factor 1.974
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 3.08 SJR 2.681 SNIP 2.741
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Web of Science (2015): Indexed yes
A Matlab-Based Educational Tool for the Seismic Design of Flexibly Supported RC Buildings

This article presents a Matlab-based educational software developed at Aristotle University of Thessaloniki in Greece, in order to familiarize students and young engineers with fundamental concepts of structural dynamics and, in particular, soil-structure interaction problems. This user-friendly educational tool aims to assist the students in comprehending the nature of this complex phenomenon and the role played by the physical parameters involved, while increasing their awareness of the potential impact of neglecting soil flexibility during seismic design of reinforced concrete (RC) buildings. This software is also used as a case study for teaching the development of civil engineering-oriented applications in Matlab within a course where all the relevant material is provided online. Two demonstration examples are comparatively assessed to illustrate the applicability of the software and justify the necessity of its implementation in class, while the integration of the software in the curriculum as well as students' feedback is also discussed. (C) 2011 Wiley Periodicals, Inc.
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Web of Science (2017): Impact factor 1.153
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Scopus rating (2016): CiteScore 1.16 SJR 0.438 SNIP 0.982
Web of Science (2016): Impact factor 0.694
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.22 SJR 0.385 SNIP 1.187
Web of Science (2015): Impact factor 0.935
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 0.64 SJR 0.354 SNIP 1.19
Web of Science (2014): Impact factor 0.296
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 0.68 SJR 0.456 SNIP 0.97
Web of Science (2013): Impact factor 0.449
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BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 0.64 SJR 0.386 SNIP 1.155
Web of Science (2012): Impact factor 0.333
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 0.5 SJR 0.297 SNIP 1.363
Web of Science (2011): Impact factor 0.333
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.329 SNIP 1.22
Web of Science (2010): Impact factor 0.321
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.29 SNIP 0.776
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.305 SNIP 0.718
Scopus rating (2007): SJR 0.284 SNIP 0.856
Scopus rating (2006): SJR 0.506 SNIP 0.537
Scopus rating (2005): SJR 0.211 SNIP 0.352
Scopus rating (2004): SJR 1.234 SNIP 0.996
Prediction of inelastic response periods of buildings based on intensity measures and analytical model parameters

This paper investigates the elongation of the fundamental period of reinforced concrete buildings that occurs during earthquake loading and its correlation with various intensity measures and engineering demand parameters. For this purpose, five buildings designed according to modern seismic codes are studied through equivalent single degree of freedom nonlinear systems with hysteretic laws that represent various levels of stiffness degradation, strength deterioration and pinching. By means of an extensive parametric analysis using a large set of earthquake ground motions and a rigorous validation procedure, the period elongation is quantitatively assessed as a function of building configuration and design (structural system and ductility class), ground motion characteristics (peak ground acceleration, spectral acceleration, frequency content) and demand parameters (displacement ductility). The results indicate that structures, designed according to modern seismic codes, are expected to exhibit low-to-moderate period elongation even for twice the intensity of the design earthquake. Given that the fundamental period of buildings is a key parameter in most seismic code procedures for ground motion selection, design and assessment, the implications of the predicted period lengthening are also discussed. The results are of interest to designers and analysts, as well as code-development committees.

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Contributors: Katsanos, E., Sextos, A., Elnashai, A.
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Web of Science (2017): Impact factor 2.755
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.93 SJR 1.547 SNIP 2.037
Web of Science (2016): Impact factor 2.258
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.59 SJR 1.631 SNIP 2.15
Web of Science (2015): Impact factor 1.893
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Seismic assessment of the second Kavala ravine bridge under alternative ground motion scenarios

General information
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Organisations: Aristotle University of Thessaloniki
Contributors: Katsanos, E., Sextos, A., Faraonis, P., Kappos, A., Karakostas, C., Lekidis, V.
Publication date: 2014

Host publication information
Title of host publication: Aseismic design and construction in Egnatia Odos, the highway connecting Epirous through Macedonia to Thrace and the eastern border of Greece
ISSARS: An integrated software environment for structure-specific earthquake ground motion selection
Current practice enables the design and assessment of structures in earthquake prone areas by performing time history analysis with the use of appropriately selected strong ground motions. This study presents a Matlab-based software environment, which is integrated with a finite element analysis package, and aims to improve the efficiency of earthquake ground motion selection by accounting for the variability of critical structural response quantities. This additional selection criterion, which is tailored to the specific structure studied, leads to more reliable estimates of the mean structural response quantities used in design, while fulfils the criteria already prescribed by the European and US seismic codes and guidelines. To demonstrate the applicability of the software environment developed, an existing irregular, multi-storey, reinforced concrete building is studied for a wide range of seismic scenarios. The results highlight the applicability of the software developed and the benefits of applying a structure-specific criterion in the process of selecting suites of earthquake motions for the seismic design and assessment. (C) 2013 Elsevier Ltd. All rights reserved.

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Organisations: Aristotle University of Thessaloniki
Contributors: Katsanos, E., Sextos, A. G.
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Scopus rating (2017): CiteScore 4.06 SJR 1.159 SNIP 2.401
Web of Science (2017): Impact factor 3.198
Web of Science (2017): Indexed yes
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Scopus rating (2016): CiteScore 3.26 SJR 0.855 SNIP 1.954
Web of Science (2016): Impact factor 3
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.54 SJR 0.751 SNIP 1.912
Web of Science (2015): Impact factor 1.673
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.13 SJR 0.723 SNIP 1.8
Web of Science (2014): Impact factor 1.402
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 2.19 SJR 0.78 SNIP 1.971
Web of Science (2013): Impact factor 1.422
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.92 SJR 0.719 SNIP 2.091
Web of Science (2012): Impact factor 1.22
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Period elongation of nonlinear systems modeled with degrading hysteretic rules

General information
State: Published
Organisations: Aristotle University of Thessaloniki
Contributors: Katsanos, E., Sextos, A., Elnashai, A.
Publication date: 2012

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An integrated system for structural analysis and earthquake records selection

General information
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Organisations: Aristotle University of Thessaloniki
Contributors: Katsanos, E., Sextos, A., Notopoulos, T.
Publication date: 2011

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Title of host publication: Proceedings of the 3rd International Conference of Computational Methods in Structural Dynamics and Earthquake Engineering
Source: PublicationPreSubmission
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Research output: Research - peer-review › Article in proceedings – Annual report year: 2011

EC8-based earthquake record selection procedure evaluation: Validation study based on observed damage of an irregular R/C building

This study investigates the applicability and limitations of the Eurocode 8 earthquake ground motion selection framework for the assessment of both elastic and inelastic structural response of multi-storey, irregular R/C buildings subjected to bi-
directional loading. In order to minimize modelling uncertainties inherent in the quantification of structural damage and the consideration of the supporting soil-foundation system for complex structural systems, an existing building damaged by the 2003 Lefkada earthquake was adopted as case study. This selection has an advantage in that ground excitation, soil profile and damage observations are all available, thus permitting calibration of the finite element model with the observed response, especially in terms of use of appropriate plasticity models and damage indices, plus the assessment of soil-structure interaction effects. After establishing a reliable finite element model of the structure under study, extensive parametric analyses for different EC8 compliant sets of records were conducted, permitting quantification of the discrepancy of the structural response due to record-to-record and set-to-set variability (i.e., intra-set and inter-set scatter, respectively). The results confirm that many of the observations found in the literature regarding the effect of ground motion selection on the predicted seismic performance of SDOF systems are also valid for bi-directionally excited, multi-storey, irregular buildings. Finally, the results also highlight specific limitations of the EC8 provisions that may lead to erroneous results in many practical cases. (C) 2010 Elsevier Ltd. All rights reserved.
On the evaluation of the EC8-based record selection procedures for the dynamic analysis of buildings and bridges

This chapter focuses on an assessment of the selection procedure for real records based on Eurocode 8 provisions, through a study of the performance of R/C bridges of the Egnatia highway system and of a multi-storey R/C building damaged during the Lefkada earthquake of 2003 in Greece. More specifically, the bridge was studied by using six alternative models and accounting for the dynamic interaction of the deck-abutment-backfill-embankment system as well as of the superstructure-foundation-subsoil system, while the building was studied in both the elastic and inelastic range taking into consideration material nonlinearity as well as the surrounding soil. Furthermore, different input sets comprising seven pairs of records (horizontal components only) from Europe, Middle-East and the US were formed in compliance with EC8 guidelines. The results of these parametric analyses permit quantification of the intra-set scatter of the seismic response for both structures, thus highlighting the current limitations of the EC8 guidelines. The chapter concludes with specific recommendations that aim at eliminating the dispersion observed in the elastic and more so in the inelastic response though appropriate modifications of EC8-proposed selection parameters.

Impact of modeling assumptions for assessing the seismic response of twin bridges considering soil-structure interaction in 3D space

This chapter focuses on the evaluation of the EC8-based record selection procedures for the dynamic analysis of buildings and bridges, through a study of the performance of R/C bridges of the Egnatia highway system and of a multi-storey R/C building damaged during the Lefkada earthquake of 2003 in Greece. More specifically, the bridge was studied by using six alternative models and accounting for the dynamic interaction of the deck-abutment-backfill-embankment system as well as of the superstructure-foundation-subsoil system, while the building was studied in both the elastic and inelastic range taking into consideration material nonlinearity as well as the surrounding soil. Furthermore, different input sets comprising seven pairs of records (horizontal components only) from Europe, Middle-East and the US were formed in compliance with EC8 guidelines. The results of these parametric analyses permit quantification of the intra-set scatter of the seismic response for both structures, thus highlighting the current limitations of the EC8 guidelines. The chapter concludes with specific recommendations that aim at eliminating the dispersion observed in the elastic and more so in the inelastic response though appropriate modifications of EC8-proposed selection parameters.
Selection of earthquake ground motion records: A state-of-the-art review from a structural engineering perspective

This paper reviews alternative selection procedures based on established methods for incorporating Strong ground motion records within the framework of seismic design of structures. Given the fact that time history signals recorded at a given site constitute a random process which is practically impossible to reproduce, considerable effort has been expended in recent years on processing actual records so as to become 'representative' of future input histories to existing as well as planned construction in earthquake-prone regions. Moreover, considerable effort has been expended to ensure that dispersion in the structural response due to usage of different earthquake records is minimized. Along these lines, the aim of this paper is to present the most recent methods developed for selecting an 'appropriate' set of records that can be used for dynamic analysis of structural systems in the context of performance-based design. A comparative evaluation of the various alternatives available indicates that the current seismic code framework is rather simplified compared to what has actually been observed, thus highlighting both the uncertainties and challenges related to the selection of earthquake records. (C) 2009 Elsevier Ltd. All rights reserved.
EC8-based selection and scaling of accelerograms for assessment of the response of a 5-story, irregular R/C building

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Organisations: Aristotle University of Thessaloniki
Contributors: Sextos, A., Katsanos, E., Georgiou, A., Manolis, G.
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Τεχνικές Προγραμματισμού και Χρήση Λογισμικού Η/Υ στις Κατασκευές

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State: Published
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Contributors: Sextos, A., Katsanos, E.
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Assessment of Soil-Structure interaction effects on the earthquake's response of steel high-rise moment resisting buildings

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Organisations: Aristotle University of Thessaloniki
Contributors: Sextos, A., DiSarno, L., Katsanos, E.
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Knowledge-based expert system for the design of R/C buildings considering soil-structure-interaction effects

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Contributors: Sextos, A., Katsanos, E.
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Projects:

Robust Identification
Friis, T., PhD Student, Department of Civil Engineering
Brincker, R., Main Supervisor, Department of Civil Engineering
Katsanos, E., Supervisor, Department of Civil Engineering
Samfinansieret - Andet
01/07/2017 → 31/07/2020
Award relations: Robust Identification
Project: PhD

An Integrated Platform for Multi-Hazard Risk Assessment of Critical Civil Infrastructures
Type: Joint Postdoctoral Research Project between the Research Groups CERDA and CESDYN
Fund: HC Ørsted Postdoc Programme co-funded by Marie Curie Actions (EU-FP7) Critical Infrastructures (CIs), being extensively interrelated with modern communities, constitute the vital lifeline to keep both society and economy functioning in a steady and prosperous rate. Thus, a protective grid of elaborate techniques and policies should be applied in order to provide safety and security for the CIs against the devastating effects of either natural or man-made threats. Along these lines, the proposed research work aims at developing a comprehensive and systematic approach for the risk assessment-management of critical civil infrastructures threatened by a multi-hazard environment during their entire life span. A holistic methodology will be carried out in order to perform a risk-based decision analysis, estimating both the direct and the indirect natural hazard consequences for a CI. At the same time, an additional sustainability-based evaluation will be implemented regarding the expected life-cycle environmental impacts from losses and recovery of the CI after adverse natural events.
Katsanos, E., Project Participant, Department of Civil Engineering, Section for Structural Engineering
01/10/2014 → 01/09/2016
Project: Research
Press clippings:

Wind farms: harvesting energy on shaky grounds and in stormy seas
Evangelos Katsanos & Sebastian Thöns
02/10/2017
Department of Civil Engineering, Section for Structural Engineering

Moving on dangerous grounds – wind power and earthquake exposures in China
02/10/2017
Denmark
Evangelos Katsanos & Sebastian Thöns
Department of Civil Engineering, Section for Structural Engineering

Insuring wind power in China against typhoons and earthquakes
Evangelos Katsanos & Sebastian Thöns
14/09/2017

Description
Les Rendez-Vous de Septembre 2017 (Monte Carlo, Monaco)
Department of Civil Engineering, Section for Structural Engineering

Moving on dangerous grounds – wind power and earthquake exposures in China
14/09/2017
Evangelos Katsanos & Sebastian Thöns
Department of Civil Engineering, Section for Structural Engineering

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