Fişa suspiciunii de plagiat / Sheet of plagiarism's suspicion	Indexat la: 50/06

Opera suspicionată (OS)	Opera autentică (OA)
Suspicious work	Authentic work

OS	BIBIRE Luminița, COBREA Codrin Robert. Solution and amplitude scaling of accelerograms for predicting the nonlinear seismic response of structures. In: Modelling and Optimization in the Machines Building Field (MOCM). 11(**2**). 2005. p.167-170.
OA	IERVOLINO, I., CORNELL, C.A. Record Selection for Nonlinear Seismic Analysis of Structures, In: Earthquake Spectra. 3(**21**). August 2005, p.685-713. Available at: http :// wpage . unina .it / iuniervo / papers / Iervolino _ and _ Cornell _ SPECTRA . pdf.

Incidența minimă a suspiciunii / Minimum incidence of suspicion	
p.167:7 - p.167:14	p.685:9 – p.685:17
p.167:29 – p.167:36	p.688:19 – p.688:28
p.168:1 – p.168:14	p.688:29 – p.689:4
p.168:15 – p.168:25	p.689:8 – p.689:21
p.168:26 – p.168:35	p.689:31 – p.689:38
p.168:38 – p.168:41	p.690:1 – p.690:5
p.168:42 – p.168:45	p.690:6 – p.690:11; p.691:1-4
p.169:Figure 1	p.690: Figure 1
p.169: Figure 2	p.690: Figure 2
p.169: Table 1	p.691: Table 1
Fişa întocmită pentru includerea suspiciunii în Indexul Operelor Plagiate în România de la www.plagiate.ro	

Incadrarea plagiatului se face din **Fişa de argumentare a faptei de plagiat** alăturată.

Argumentarea calificării

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Actualizat la 7 iulie 2015.

Notă: Prin „proveniență” se înțelege informația din care se pot identifica cel puțin numele autorului / autorilor, titlul operei, anul apariției.

SOLUTION AND AMPLITUDE SCALING OF ACCELEROGRAMS FOR PREDICTING THE NONLINEAR SEISMIC RESPONSE OF STRUCTURES

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Abstract: This paper hypothesizes that neither these usual principal seismological characteristics nor scaling of records matters to the nonlinear response of structures. It then investigates under what conditions this hypothesis may not be sustainable. Two classes of records sets are compared in several study cases: one class is carefully chosen to represent a specific magnitude and distance scenario, and another class is chosen randomly from a large catalogue. Results of time-history analyses are formally compared by a simple statistical hypothesis test to assess the difference, if any, between non-linear demands of the two classes of records.

Keywords: high structure, response, amplitude, nonlinear, seismic

1. INTRODUCTION

The effect of the degree of scaling (by first-mode spectral acceleration level) is investigated in the same way. Results here show

(1) little evidence to support the need for a careful site-specific process of record selection by magnitude and distance and

(2) that concern over scenario-to-scenario record scaling, at least within the limits tested, may not be justified.

In several structural types are considered belonging to both single-degree-of-freedom (SDOF) and multi-degree-of-freedom (MDOF) systems. SDOF systems are chosen to vary across a range of periods, backbones, and target ductility. The MDOF systems belong to moderate period structures and have been chosen to represent quite different structural configurations. They include older reinforced concrete structures and steel moment resisting frames with brittle connections.

2. TARGET SETS FOR THE RECORD SELECTION

The target sets for the record selection study are designed to be representative of a specific scenario event (magnitude and distance) that might be the realistic threat at a particular site, here a moment magnitude 7 at 20 km, defined as closest distance to fault rupture. This target event was chosen to be as large and close as feasible given the wish to have several samples of the target sets and given the limited number of large magnitude, close records in the special catalogue. (The records must also respect the general selection criteria presented just above.) In order to best represent what might occur in the future and to reduce correlation or “overlapping” due to event commonality, it is desirable to have the ten records in each set come from ten different events. This requirement conflicts with the desire to have a large target magnitude and to sample events close to the target in magnitude. The compromise was to use five events and two records per event. This decision led to five events with magnitude range 6.7 to 7.4.

Starting from this point six different sets of ten records each have been arranged such that almost all the records are in the narrow distance range 20 ± 5 km. The comparatively small sample size of ten events in each set has been chosen because ten is the order of magnitude of size used in recommended earthquake engineering practice (which is typically as small as three to seven) (The total, or pooled, set of all records will also be considered but the breakdown into sets of a more conventional size is considered more representative and hence more instructive and transparent.) Further no two target sets have more than one record in common out of the ten; complete avoidance of overlap was not feasible because not all five events had the twelve records necessary to fill out the six target sets within or near the distance range. These selection limitations on events and records are designed to make the sets as nearly independent as possible given the limited number of records available. The records in the target sets are named: T1a, T1b, T2a, T2b, T3a and T3b. Sets with a common number such as T1a and T1b contain components from precisely the same ten three component recordings. The “a” and “b” refer to the fact one horizontal component is used in “a” and the other in “b”.

These sets were chosen effectively randomly from the catalog without regard to magnitude or distance subject only to the general constraints presented above (for example, Romania type and distance). The *arbitrary sets* are ten sets of ten records each. They come from California events in a comparatively wide range of moderate magnitudes ($6.4 < M < 7.4$) and distances ($15 < R < 50$ km). The records in each set are chosen randomly (*without* replacement) first from the list of events, insuring ten different events in this case, and then from the available distances within each selected event - to the degree possible; because of limits on the number of recordings/distances in such event, it was necessary to have two records from one event in some cases in order to construct ten arbitrary sets. The upper bound is the limit of the catalogue; the lower bound of 6.4 was selected because it is a full magnitude unit below the upper value and because there are sufficient events and records in the catalogue that in practical application one need go no lower than this to have a large sample from which to select the relatively few records (three to ten) that are needed in an application.

To establish the validity of the (over) simply stated hypothesis that “does not matter how one selects records”, a series of structures have to be chosen. In order to make the conclusions of the study broad wide-raging cases have been considered. The different structural features considered to be most meaningful to be investigated are:

(1) first natural period;
(2) force-deformation or hysteresis relationship;
(3) target ductility;
(4) number of degrees of freedom;
(5) structural type (concrete or steel).

For each of these factors a wide range has been considered in order to help establish the limits of acceptance of the hypothesis.

3. SINGLE DEGREE OF FREEDOM (SDOF) AND MULTIPLE DEGREE OF FREEDOM SYSTEMS (MDOF)

Three different periods SDOF systems have been considered, very short (0.1 sec) moderate (1.5 sec) and very long (4 sec), in order to investigate if conclusions reached to at moderate periods seem to hold at extreme periods. Most nonlinear SDOF system study is based on simple bilinear systems with a second stiffness equal to 3% of the first; see Fig.1 for a hysteresis rule example.

For each of the three periods two yield strengths are selected to give median ductility of approximately 2 and 6 under the target records. Viscous damping is always 5% of critical. For the most interesting, moderate period case ($T = 1.5$ sec case), a second trilinear backbone with a degrading strength branch (see Fig.2) is considered, again with two strength levels.

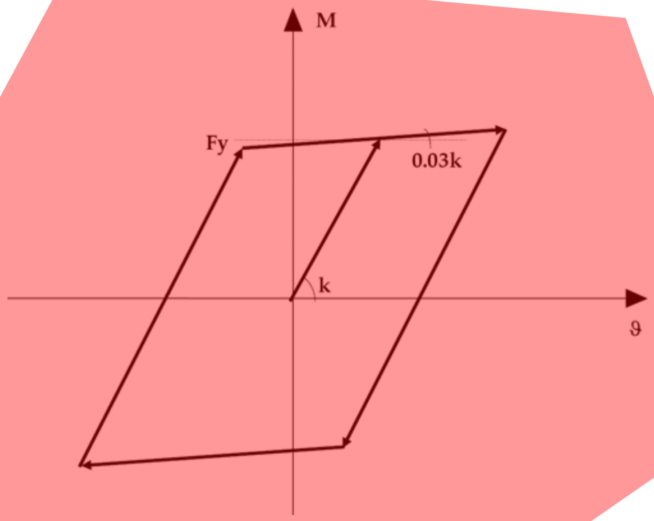

Figure 1. SDOF bilinear hysteresis.

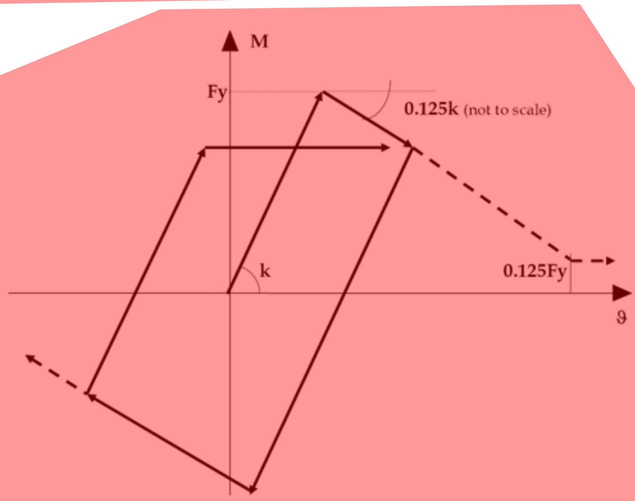

Figure 2. SDOF strength-degrading trilinear hysteresis.

Table 1 summarizes the SDOF structural configurations analyzed under both the target and the arbitrary groups of sets.

Table 1. SDOF cases.

Period	T=1.5 sec.				T=0.1 sec.		T=4 sec.	
Backbone	Bilinear		Trilinear		Bilinear		Trilinear	
Ductility	2	6	2	6	2	6	2	6

Both of the MDOF structural models are moment-resisting frames, one of reinforced concrete (RC) and one of steel. The reinforced concrete structure is modeled with strength degrading moment and shear behavior in the nonlinear range of the member-end hinges. Moment frames along the perimeter provide the primary seismic force resistance.

4. CONCLUSIONS

The SDOF and MDOF cases presented have been analyzed with the groups of sets described as input. The considered response parameter is the peak-in-time drift for the single degree of freedom cases and the maximum interstory peak drift over all the stories for the MDOF cases. The latter is used in recent criteria for frame structures such as the SAC steel project (see, e.g., Gupta and Krawinkler 1999) as an indicator of the extreme rotation demands in the joints and of possible collapse due to global instability. We shall refer to these as simply "drift" in what follows.

Finally before making the arbitrary to target set comparisons, the target sets have been compared to confirm that they are "equivalent". This means that the target set responses have been statistically compared among themselves that the hypothesis of equality of medians has been accepted. Observation of the typical ratios observed shows that the small sample results may either be above or below unity for all the cases. Looking solely at the large sample ratios, one might want to conclude that the arbitrary records produce somewhat high responses for the Trilinear and 0.1 sec bilinear cases; while in the 4 sec bilinear case they may induce somewhat low responses at higher ductility. But, given the large dispersions, these conclusions cannot be supported statistically by this data. In fact taken together, the tables and summaries give little or no support to the notion that one should expect major systematic errors in the estimated nonlinear responses if he selects the records simply at random from a catalog with a comparatively wide magnitude and distance range, rather than carefully selecting records that match the mean or modal {M, R}.

Cases that may display some sensitivity to magnitude include tall buildings with important second-mode effects and very short period systems. The case of small magnitudes (less than 6, say), which may be important in certain low seismicity regions and for which the shape of the records Fourier or response spectra may be more strongly magnitude dependent, has not received as much study. It is apparently the magnitude-dependence of the shape of the spectrum that drives any such magnitude dependence.

REFERENCE

[1] Iervolino, I., 2004 *Record Selection for Nonlinear Seismic Analysis of Structures*, M. Sc. Thesis, Roseschool, Institute for Advanced Study - University of Pavia, Italy. Advisor: C. A. Cornell. [http://www.roseschool.it/files/research-students-MD2004-iervolino.htm];

[2] Jalayer, F., 2003. *Direct Probabilistic Seismic Analysis: Implementing Non-Linear Dynamic Assessments*, Ph. D. Thesis, Dept. of Civil and Environmental Engineering, Stanford University, Stanford, CA. Advisor: C. A. Cornell. [http://www.stanford.edu/group/rms/];

[3] McGuire, RK., 1995. *Probabilistic Seismic Hazard Analysis and Design Earthquakes: Closing the Loop,* Bulletin of Seismological Society of America **85**, No. 5;

[4] Medina R. A. 2002. *Seismic Demands For Nondeteriorating Frame Structures And Their Dependence On Ground Motio*n. Ph. D. Thesis, Dept. of Civil and Environmental Engineering, Stanford University, Stanford, CA. Advisor: H. Krawinkler.