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Proposal for a new technology accelerographs benchmark: Some early results obtained from digital records analysis

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The availability of a large number of new technology accelerographs generated a great aspectative of recording characterized by an increased frequency interval where the spectrum is still reliable. Further the availability of a pre-event memory toghether with an A/D converter should supply scientist with data that do not need high-pass filtering (i.e. if the sensor noise is negligible). Then the corrected velocity and displacement will be obtained by direct integration and the following step will be the "seismologist dream" : to recover the permanent displacement of the ground. Furthermore the improved signal-to-noise ratio at both the ends of the spectrum will encourage acquisition and processing of small amplitude records (low energy records) obtained either by large event recorded far from the source or by a small seismic event recorded near the source. There are opinions on literature, that small recordings should help seismologist and engineers to recover some informations from the source that can be used to compute the seismic input at a certain site. Further, if permanent arrays, based on analogue instruments, should be up-to-date with digital accelerographs then is necessary to know in advance:

if the added informations are realy needed;

which is the real improvement we can expect from a certain digital instrument;

how good is the behaviour of digital instruments wen left on the field.

To try to ansewer some of the previous questions a benchmark to analyze several different digital accelerographs has been thougt; in particular the following activities are skeduled:

- shake-table tests to evaluate the sensors frequency response;

- selection of a site test near Rome to compare digital instruments behaviour during a seismic event.

Preliminary results:

Fig. 1 to 8 show results of a comparison between records obtained by an

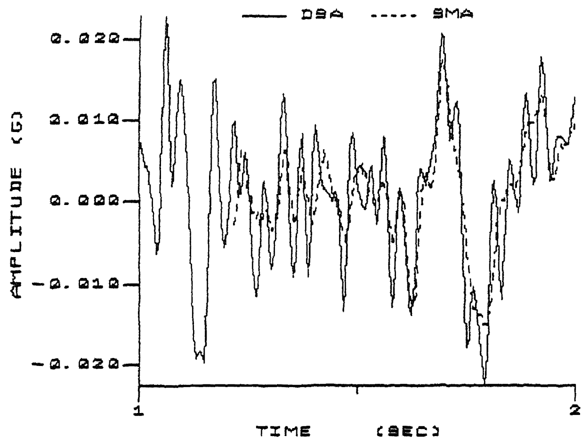

Fig. 1 Campano-Lucano Earthquake of 25 November 1980; recorded at Procisa Nuova; blow-up (1-2 sec.) of the UP component.

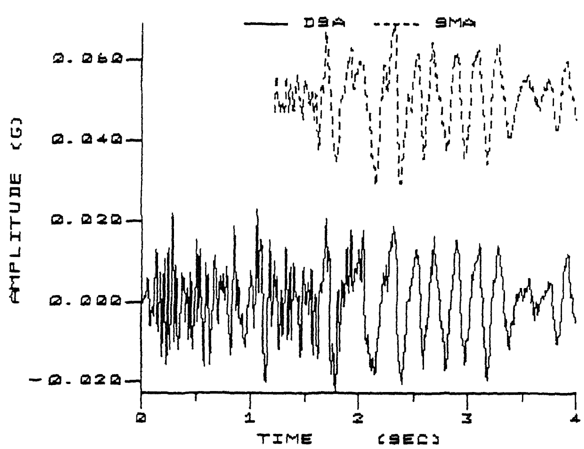

Fig. 2 Campano-Lucano Earthquake of 25 November 1980; recorded at Procisa Nuova; comparison between digital and analogue records.

analogue and a digital accelerograph installed on the same pillar. It is evident that the missing part of the record is more important for the low energy record (fig. 2). Further the lack of energy at high frequency (fig. 1) for the record obtained during the Campano-Lucano Earthquake of 1980 is not represented on the record obtained at Coalinga during the 1983 seismic event. Fig. 5 shows a comparison between the Fourier Amplitude Spectra (FAS) of the acceleration recorded at Coalinga both by a digital and by an analogue instrument. The difference on the FAS is negligible and may be apreciated only at very low frequency (< 0.3 Hz). Nevertheless, if comparison is made between the Acceleration Response Spectra (ARS), it is noticeable that the asintotic trends are

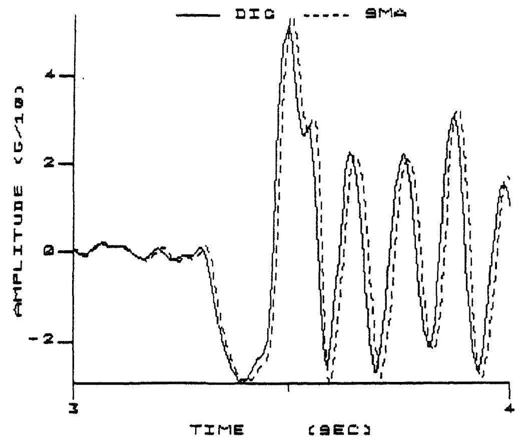

Fig. 3 Coalinga Earthquake of 21 July 1983; blow-up (3-4 sec.) .

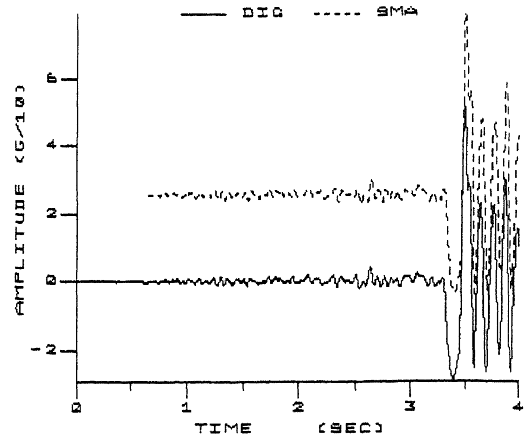

Fig. 4 Coalinga Earthquake of 21 July 1983; comparison between digital and analogue records .

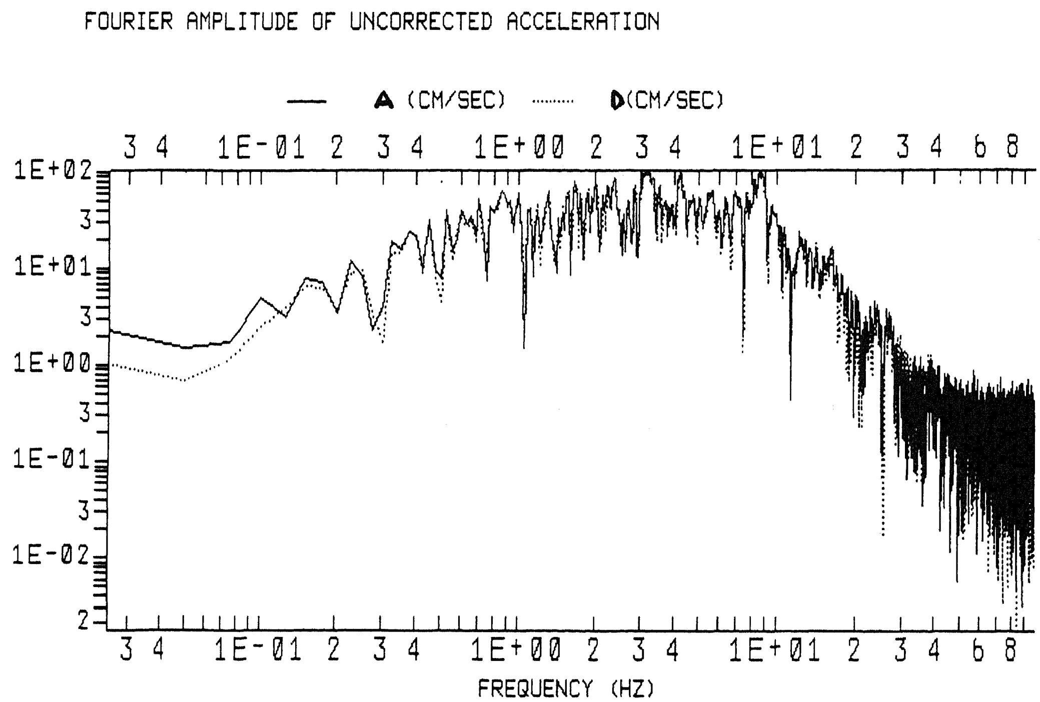

Fig. 5 Coalinga Earthquake of 21 July 1983; FAS of the analogue record (A) compared to a FAS of a digital record (D).

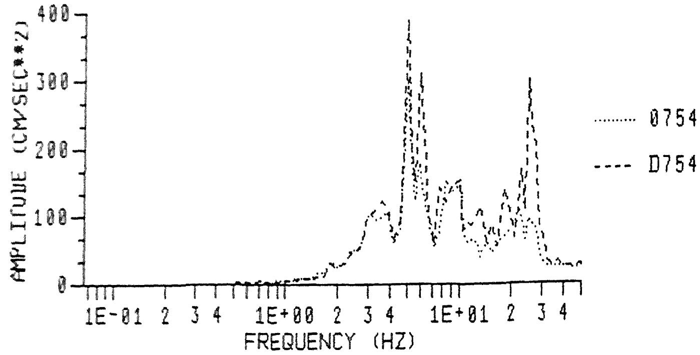

Fig. 6 Campano-Lucano Earthquake of 25 November 1980; ARS of the analogue record (A) compared to a ARS of a digital record (D).

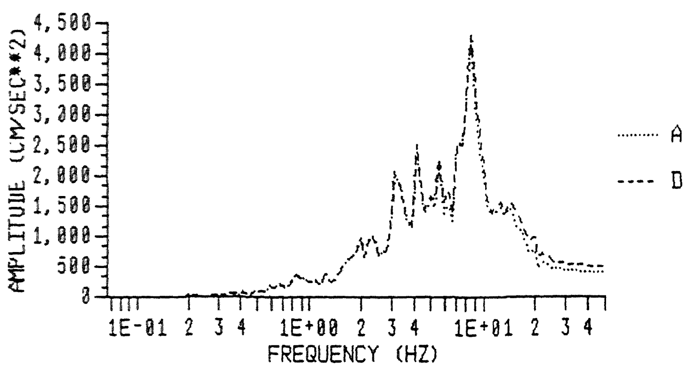

Fig. 7 Coalinga Earthquake of 21 July 1983; ARS of the analogue record (A) compared to a ARS of a digital record (D).

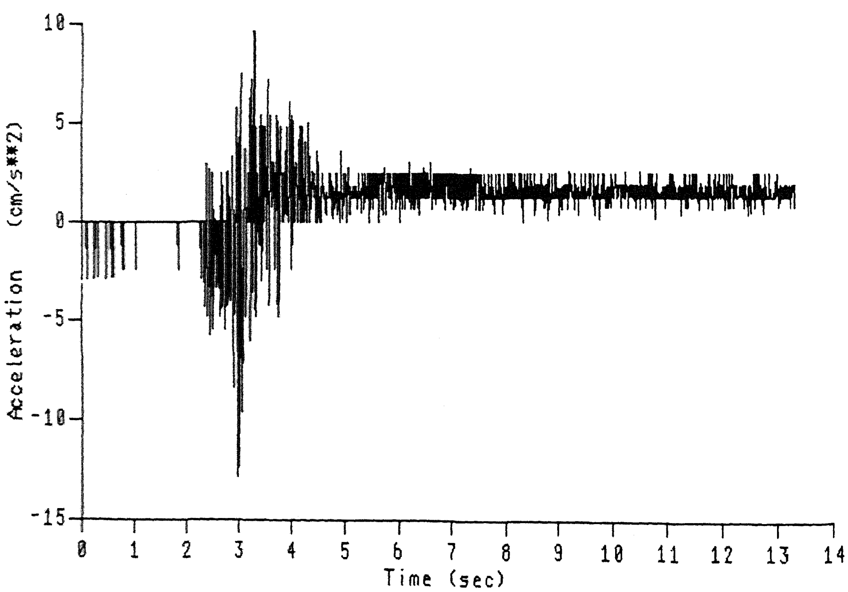

Fig. 8 Cerreto di Spoleto Earthquake of 17 December 1989; recorded at Borgo Cerreto; UP component

slightly different at high frequency. Further, differences between ARS of the Campano-Lucano Earthquake records (analogue versus digital) are not noticeable on Coalinga records. This may be justified, as stated previously, by the different amplitude of records and also by the fact that vertical components (Campano-Lucano Earthquake) are reacher on high frequency than horizontal components (Coalinga). Finally fig. 8 shows how irrealistic is the confidence on digital instruments if a certain kind of sensor is selected (piezoelectric accelerometer).