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B.tech Electrical and Computer Engineering

2019-2023 Batch

Mini Project /Lab Assignment

Seismic Analysis

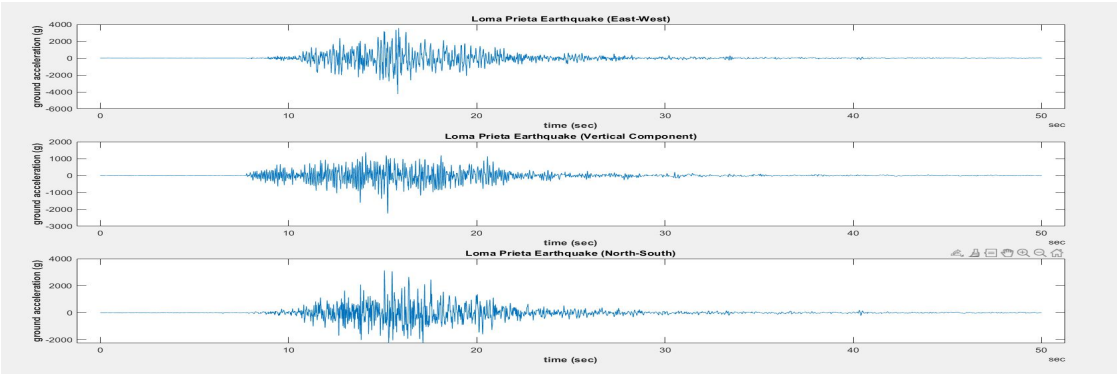
Introduction:

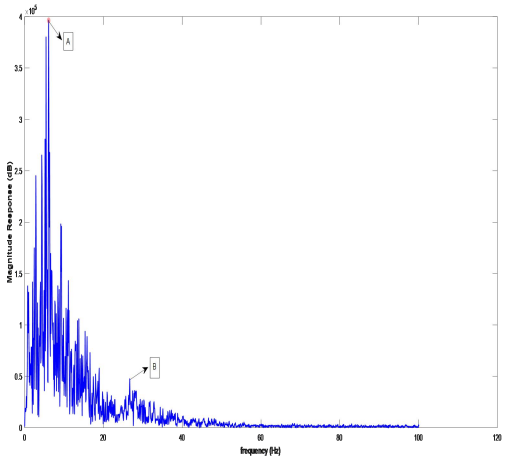
The main objective of our mini project is to analyse seismic waves and to extract useful information from the data here we are trying to understand the different types of seismic waves and various frequency components associated with it. So for the analysis of seismic waves we considered the data of Loma-Prieta earthquake from October 17,1989 .

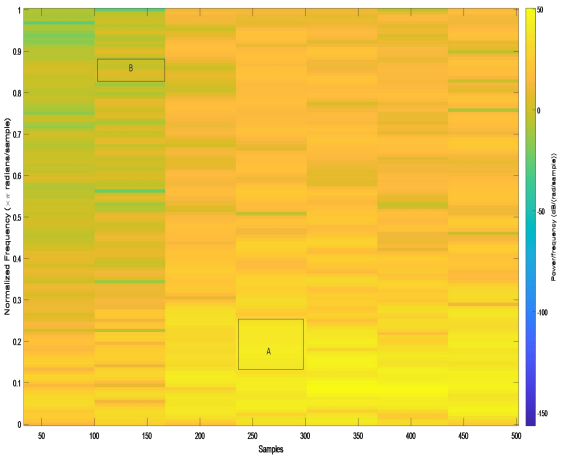
Concepts involved:

To understand the data of the earthquake we are using FFT and time frequency graphs.FFT is used to analyse the different frequency components associated with the earthquake the sampling frequency is taken as 200Hz ,based on the accelerometer used to record the earth quake .Time frequency graphs are used to simultaneously show the energy associated with frequencies with respect to time.

Results:







Observation Tables:

P-Wave Arrival Time(sec)	S-Wave Arrival Time(sec)	Lag Time(sec)
8	15	7

Magnitude observation table:

Distance to the focus using the interval time between the S and the P waves(Lag time)	Height of the maximum wave motion on seismogram	Straight edge between appropriate points on the distance and amplitude scales yields local magnitude(M_l)
S – P = 7 seconds	355.8 millimeters	6.93

Energy Calculation:

The energy release can also be roughly estimated by converting the moment magnitude to energy using the equation log E = 5.24 + 1.44M, where M is the magnitude.

E = 1.56675107 * (10^15)

Observations/Inference:

FFT is used to find how much noise is present inside the signal Normally noise is in the range of 0.5 to 1 Hz Since we are doing in mat lab and our data is refined we do not have noise and has been removed before analysis.For global frequency distributions in which no fine time resolution is necessary, the spectrogram is well suited to identify the dominant frequencies contained in the seismic signals. The time resolution of the SP is limited, and restricts its use for highly time resolved earthquake wave signal characterization.It is also possible to observe that the times when the maximum amplitudes occur in the time domain of the earthquake record also correspond to the times where several time frequency characteristics of the signal "converge".The earthquake magnitude is found to be M = 6.93 according to the Ritcher-scale the earthquake is categorized as strong and moderate damage may be done to highly populated areas.

Reference:

Aki, K. and Tsujiura M. (1959), "Correlation study of near earthquake waves", Bull. Earthq. Res. Inst., 37, pp 207-231.

Allen, J. B. and Rabiner L. (1977), "A unified approach to short-time-Fourier analysis and synthesis", Proc. IEEE, 65, 11, pp1558-1564.

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