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EVALUATION OF FOURIER INTEGRAL. SPECTRAL ANALYSIS OF SEISMICAL EVENTS

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Abstract. Spectral analysis of seismical events represent a methode for greats earthquakes prediction. Seismical signal is not a sinusoidal signal; for this, it's necessary to find a methode for best aproximation of real signal with a sinusoidal signal.

The broad-band station "Quanterra" allow the data acces in numeral and/or graphical forms. With numeral form we can make very easy a computer program (MSOFFICE-EXCEL) for spectral analysis.

Key words: prediction, spectrum, Quanterra

1. INTRODUCTION

Acquisition and computerizing processing of seismical events allow the access at the digital form of the event (sampling and cuantification).

At Seismological Observatory "MUNTELE ROSU" the acquisition of seismical events is getting with the broadband station, "QUANTERRA".

The seismical event is available both in graphic form and numeral form. The numeral form enable to make very easy a computer program wich allow the vizualization of earthquakes spectrum. For this study it utilise the first four seconds of "P" waves.

The sampling of the seismical signal is getting respecting Shannon theorem.

Graphic:

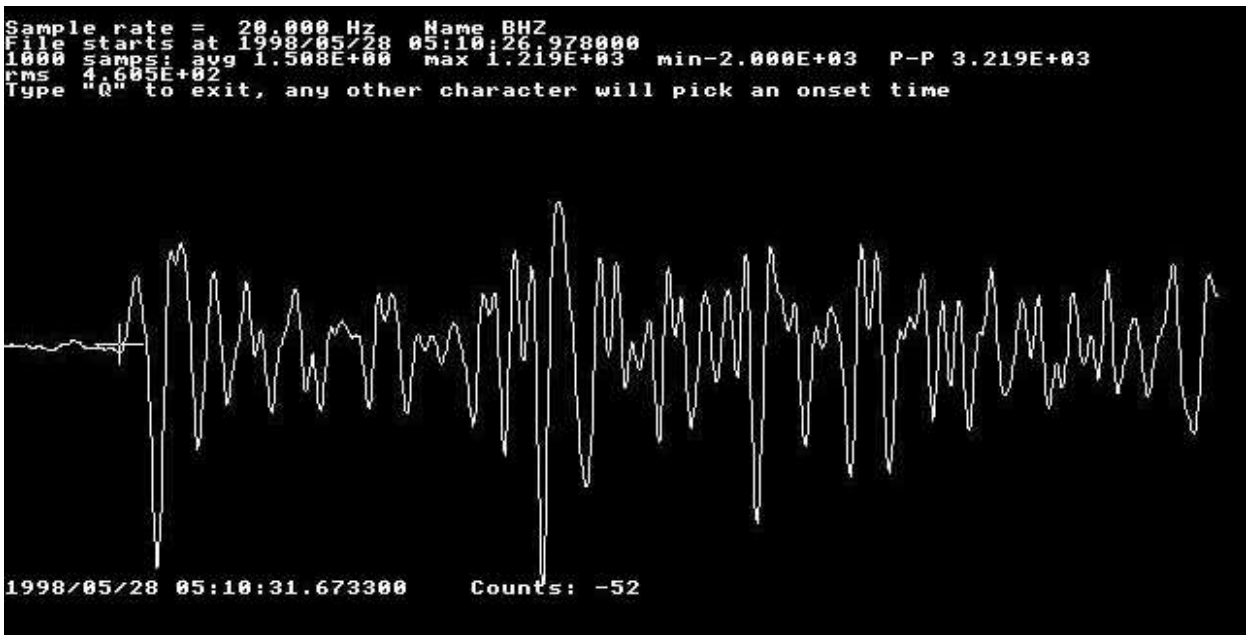

Fig.1

Numeral:

-394 -393 -386 -372 -347 -312 -265 -200 -2669
-115 -17 82 181 274 349 391 395 1540
360 293 207 109 10 -67 -95 -61 756
27 149 281 387 431 398 293 134 2100
-48 -221 -361 -462 -516 -516 -471 -397 -2992
-310 -226 -165 -141 -160 -217 -284 -331 -1834

2.APROXIMATION METHODE

Numerical evaluation of the Fourier integral require the integration of the equation (Cyril M.Harris et al.[1])

$$F(\omega) = \int_{-\infty,\infty} f(t)e^{-i\omega t}\,dt \qquad (1)$$

In seismology, the function f(t) is too complicate; the integral can't be analytic calculate; but, if it dispose of numerical dates it's possible to use this methode:

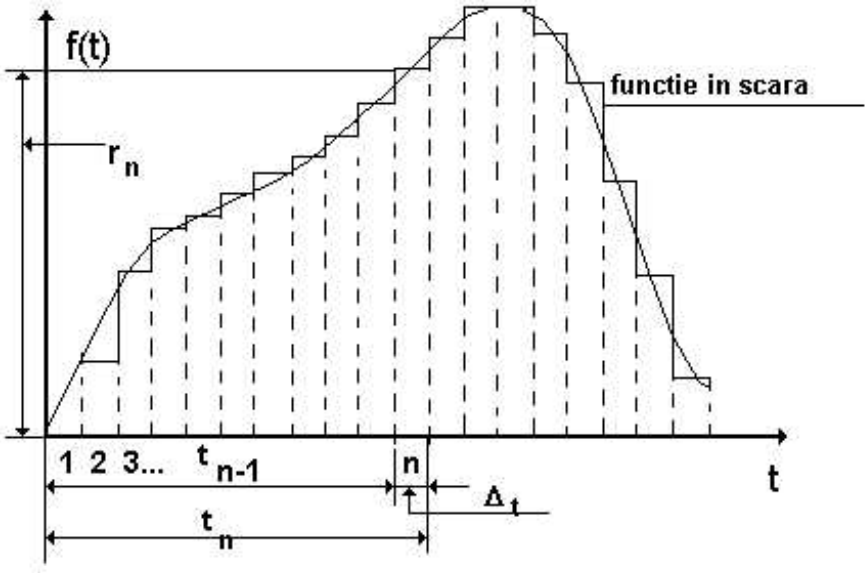

Fig.2

$t_{n-1} = (n-1)\Delta t$ şi $t_n = n\Delta t$

Calculating (1):

$$F_n(\omega) = \frac{2r_n}{\Omega}\sin\left(\frac{\omega\Delta t}{2}\right) e^{-I(2n-1)\omega\Delta t/2} \qquad (2)$$

If in (2) we write: $\psi = \frac{\Omega \Delta t}{2}$

$$F_n(\omega) = \frac{r_n \Delta t}{\psi} \sin\psi e^{-I(2n-1)\psi} \qquad (3)$$

$$R[F_n(\omega)] = r_n \Delta t \frac{\sin\psi\cos(2n-1)\psi}{\Psi} \qquad (4)$$

$$I[F_n(\omega)] = - r_n \Delta t \frac{\sin\psi\sin(2n-1)\psi}{\psi}$$

$$R[F(\omega)] = \Delta t \sum_n r_n \frac{\sin\psi\cos(2n-1)\psi}{\psi} \qquad (5)$$

$$I[F(\omega)] = - \Delta t \sum_n r_n \frac{\sin\psi\sin(2n-1)\psi}{\psi}$$

$$F(\omega) = \{R^2[F(\omega)] + I^2[F(\omega)]\}^{1/2} \qquad (6)$$

From these relations, knowing the number of samples, "n" and the value of each sample "(r_n)", it can know the spectrum.
The spectral analysis program is make in Excel. The program is small (130Kb HDD) and "elastic".

For more details about importance of spectral analysis in seismology, see (D.Enescu et al.[2])

3.SPECTRUM EXAMPLE

Fig. 3 show a spectrum example.

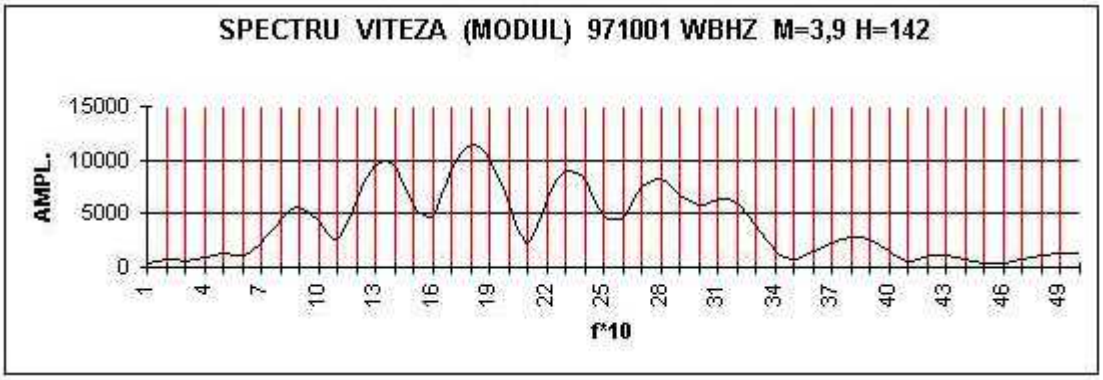

Fig.3

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