**AIN SHAMS UNIVERSITY**
**FACULTY OF SCIENCE**

# HIGH FREQUENCY EARTHQUAKE GROUND-MOTION SCALING IN NORTHERN EGYPT

***A THESIS***
***SUBMITTED FOR THE AWARD OF THE DEGREE***
***OF DOCTOR OF PHILOSOPHY IN GEOPHYSICS***

**By**

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## *ABSTRACT*

# High frequency earthquake ground-motion scaling in Northern Egypt.

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The northern part of Egypt has attained a spectacular interest, since the announcement of the government to erect the first nuclear power plant to generate electricity. Also, that part of Egypt compresses the major cities of the Egyptian territory, where most of the mega projects take place. This, together with the overpopulation in this part, motivated many researchers to study the earthquake hazards and the related earthquake engineering topics.

Ground motion scaling relations are the base for seismic hazard assessment studies. We used more than 650 seismograms recorded in 65 earthquakes located in Northern Egypt by the Egyptian National Seismological Network (ENSN), through the period from August 1997 to December 2007, to scale the ground motion in Northern Egypt.

The data set was chosen carefully to overcome certain specifications and to get stable regression analyses. First, all the events were re-located to get precise focal parameters and to judge the used location programs by the ENSN, where we found that these programs, to some extent, are good for the routine work, except for the magnitude calculations. So, we used the genetic algorithm to calculate the source parameters and the moment magnitude for events in the range from 2.6 to 4.08. The genetic algorithm was an effective tool for controlling these parameters and finally we compared the obtained moment magnitudes using the genetic algorithm Mw(GA) and those calculated by the ENSN (ML). A formula was established between ML(ENSN) and the Mw(GA) as:

$$ML(ENSN) = 0.752 \times Mw(GA) + 1.389$$

For the moment, this formula is recommended to be used to correct for magnitude, but the calibration of ML(ENSN) is to be done as a complimentary part of this thesis upon the results obtained describing the decay of amplitude with hypocentral distance.

In order to empirically obtain the scaling relations for the high frequency ground motion in Northern Egypt, regression analysis was carried on the data set, that covered a hypocetral distance of 550 km. The analyses were done at centered frequencies 1.0, 2.0, 3.0, 4.0, 6.0, 8.0, 10.0, and 12.0 Hz.