ABSTRACT

The objective of this thesis, which consists of three chapters, is to study the periodic solutions of types (harmonic, sub-harmonic of even and odd order), for a weakly non-linear second order differential equation:

$$\ddot{x} + k_1 x + k_3 x^3 + k_4 x^4 + k_2 x^3 \cos(\Omega t) = 0$$

where k_1, k_2, k_3, k_4 are constants. This equation governed certain dynamical system, subjected to parametric excitation.

The study is focused on

i. Proving the existence of different kinds of periodic solutions, by using the index method.
ii. Localizing them in the plane $(k_1 - k_2)$, for given initial point $(x_0, \dot{x}_0)$, and fixed values of k_3, k_4.
iii. Establishing approximate analytical formulas to different types of periodic solutions by using a perturbation method (generalized averaging method).

Chapter one is devoted to the presentation of the index method and using it for proving the existence and localizing the periodic solutions of types harmonic and sub-harmonic of order $\frac{1}{2}, \frac{1}{4}, \frac{1}{3}, \frac{1}{5}$ in the plane $(k_1 - k_2)$, for given initial point $(x_0, \dot{x}_0)$, and for fixed values of k_3, k_4.