

**SIMPLE EQUATIONS WITH COMPLEX BIFURCATION DIAGRAM:  
HILL'S EQUATIONS WITH PERIODIC COEFFICIENTS**

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Equations of Hill type  $x'' + (a + bp(t))x = 0$ ,  $p$  being a periodic function and  $a, b$  real parameters appear in many applications, mainly in the stability of periodic orbits of Hamiltonian systems. They can also be considered as simple Schroedinger operators with periodic potential. The simplest one is Mathieu equation, when  $p(t) = \cos(t)$ .

Despite the equation is linear, the dependence of the solutions and, in particular the stability properties IS NOT. This is a source of a very interesting behaviour which can be read off in the bifurcation diagram. Has immediate consequences for the spectrum in Schroedinger.

The perturbative case ( $b$  small) is elementary and can be studied using normal forms.

The goal of the talk is to present the results for  $a, b$  arbitrarily large, to describe the asymptotic behaviour and to sketch the tools which are required in the proofs. Some numerical examples will be shown.