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AUTONOMOUS DYNAMICAL SYSTEMS WITH PERIODIC COEFFICIENTS

Bruno Rosseto and Jean-Marc Ginoux

PROTEE Laboratory
Université du Sud, B.P. 20132, 83957, La Garde Cedex, France

Corresponding author email:ginoux@univ-tln.fr

Abstract. The solutions of autonomous dynamical systems with periodic coefficients mainly depend on the Floquet-Liapunov exponents of a Hill's associated equation. These exponents are computed without integration by a very fast algorithm which exponentially converges. So, some important features of the solutions behaviour, such as the location of the temporal mean in the phase plane, funnelling phenomenon, period doubling, parametric resonances, can be specified. In this paper, the implementation of the method is shown on a parametric Van der Pol equation.

Keywords. slow-fast dynamics, Floquet-Liapunov exponents, Hill's equation.

1 Some previous results

Consider the Van der Pol equation:

$$\left\{ \begin{array}{lll} \varepsilon \dfrac{dx\left(t\right)}{dt} & = & -\dfrac{x^3}{3} + x + y \\ \dfrac{dy\left(t\right)}{dt} & = & -x \end{array} \right. \tag{1}$$

where $\varepsilon = 0.05$. In previous works, we established that the location of the points where the curvature of the trajectory in the phase plane vanishes provides the following equation of a slow manifold [1]:

$$\phi = y - \frac{x^5 - 4x^3 + 3x\left(1-\varepsilon\right)}{3\left(x^2-1\right)} = 0 \tag{2}$$

Moreover, the attractive part of this manifold, given by

$$\vec{V}.\vec{\nabla}\phi > 0$$

is an invariant manifold.