

L^AT_EX Template for LNCS

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Abstract. The abstract should summarize the contents of the paper using at least 70 and at most 150 words. It will be set in 9-point font size and be inset 1.0 cm from the right and left margins. There will be two blank lines before and after the Abstract.

Key words: high-level Petri nets, net components

1 Section Title

In this section, we will consider the case when the Hamiltonian $H(x)$ is autonomous. For the sake of simplicity, we shall also assume that it is C^1 .

We shall first consider the question of nontriviality, within the general framework of (A_∞, B_∞) -subquadratic Hamiltonians. In the second subsection, we shall look into the special case when H is $(0, b_\infty)$ -subquadratic, and we shall try to derive additional information.

1.1 Subsection Title

Theorem 1 tells us that if $\lambda + \gamma < 0$, the boundary-value problem:

$$\begin{aligned} \dot{x} &= JH'(x) \\ x(0) &= x(T) \end{aligned} \tag{1}$$

Proposition 1. Assume $H'(0) = 0$ and $H(0) = 0$. Set:

$$\delta := \liminf_{x \rightarrow 0} 2N(x) \|x\|^{-2} . \tag{2}$$

If $\gamma < -\lambda < \delta$, the solution \bar{u} is non-zero:

$$\bar{x}(t) \neq 0 \quad \forall t . \tag{3}$$

Proof. Condition (2) means that, for every $\delta' > \delta$, there is some $\varepsilon > 0$ such that

$$\|x\| \leq \varepsilon \Rightarrow N(x) \leq \frac{\delta'}{2} \|x\|^2 . \tag{4}$$

On the other hand, we check directly that $\psi(0) = 0$. This shows that 0 cannot be a minimizer of ψ , not even a local one. So $\bar{u} \neq 0$ and $\bar{u} \neq \Lambda_o^{-1}(0) = 0$. \square

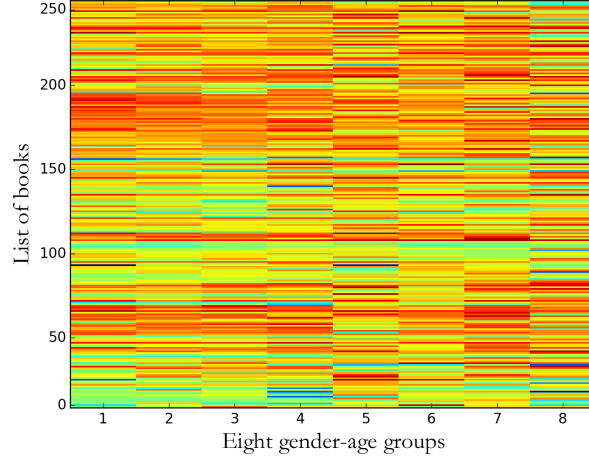


Fig. 1. A figure example.

Corollary 1. Assume H is C^2 and (a_∞, b_∞) -subquadratic at infinity. Let ξ_1, \dots, ξ_N be the equilibria, that is, the solutions of $H'(\xi) = 0$.

Proof. The condition $\gamma < -\lambda < \delta$ now becomes:

$$b_\infty - a_\infty < -\frac{2\pi}{T}k_o - a_\infty < \omega - a_\infty \quad (5)$$

which is precisely condition . \square

Notes and Comments. The results in this section are a refined version of [?]; the minimality result of Proposition 14 was the first of its kind.

To understand the nontriviality conditions, such as the one in formula (??), one may think of a one-parameter family x_T , $T \in (2\pi\omega^{-1}, 2\pi b_\infty^{-1})$ of periodic solutions, $x_T(0) = x_T(T)$, with x_T going away to infinity when $T \rightarrow 2\pi\omega^{-1}$, which is the period of the linearized system at 0.

Table 1. This is the example table taken out of *The T_EXbook*, p. 246

Year	World population
8000 B.C.	5,000,000
50 A.D.	200,000,000
1650 A.D.	500,000,000
1945 A.D.	2,300,000,000
1980 A.D.	4,400,000,000

Theorem 1 (Ghoussoub-Preiss). *Assume $H(t, x)$ is $(0, \varepsilon)$ -subquadratic at infinity for all $\varepsilon > 0$, and T -periodic in t*

$$H(t, \cdot) \quad \text{is convex} \quad \forall t \quad (6)$$

$$H(\cdot, x) \quad \text{is } T\text{-periodic} \quad \forall x \quad (7)$$

$$H(t, x) \geq n(\|x\|) \quad \text{with } n(s)s^{-1} \rightarrow \infty \quad \text{as } s \rightarrow \infty \quad (8)$$

$$\forall \varepsilon > 0, \quad \exists c : H(t, x) \leq \frac{\varepsilon}{2} \|x\|^2 + c. \quad (9)$$

Assume also that H is C^2 , and $H''(t, x)$ is positive definite everywhere. Then there is a sequence x_k , $k \in \mathbb{N}$, of kT -periodic solutions of the system

$$\dot{x} = JH'(t, x) \quad (10)$$

such that, for every $k \in \mathbb{N}$, there is some $p_o \in \mathbb{N}$ with:

$$p \geq p_o \Rightarrow x_{pk} \neq x_k. \quad (11)$$

□

Definition 1. *Let $A_\infty(t)$ and $B_\infty(t)$ be symmetric operators in \mathbb{R}^{2n} , depending continuously on $t \in [0, T]$, such that $A_\infty(t) \leq B_\infty(t)$ for all t .*

Note that, if $k < 0$, it is not convex.

The first results on subharmonics were obtained by Foster and Kesselman in [3, 1], who showed the existence of infinitely many subharmonics both in the subquadratic and superquadratic case, with suitable growth conditions on H' . Again the duality approach enabled Foster and Waterman in [2] to treat the same problem in the convex-subquadratic case, with growth conditions on H only.

Recently, Smith and Waterman (see [1] and May et al. [2]) have obtained lower bound on the number of subharmonics of period kT , based on symmetry considerations and on pinching estimates, as in Sect. 5.2 of this article [1].

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