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HOMOCLINIC SOLUTIONS FOR A CLASS OF SYSTEMS OF SECOND ORDER DIFFERENTIAL EQUATIONS

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Dedicated to Louis Nirenberg

1. Introduction

Variational methods have recently been applied to the search of homoclinic solutions for first and second order Hamiltonian systems (see e.g. [1, 2, 3, 6] and the references therein). Homoclinic solutions obtained there are mountain pass points for suitable functionals, namely either the Lagrangian functional or its dual with respect to the Legendre transform. In order to apply the mountain pass theorem to the Lagrangian functional, one requires that the spectrum of the operator describing the system linearized at zero is contained in $(0,\infty)$, while to switch to the dual functional it is necessary to assume that the potential (or the Hamiltonian) is the sum of a quadratic and a convex part. Furthermore, the potential of the second order systems treated in the above cited references is required to have a local maximum at zero.

In this paper we prove the existence of a nontrivial homoclinic solution of the system of second order differential equations

$$\ddot{q}(t) + A(t)q(t) = -W_q(q(t),t), \qquad q \in \mathbb{R}^N,\ t \in \mathbb{R}. \tag{1}$$

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