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A MULTIPLICITY RESULT OF PERIODIC SOLUTIONS FOR PARAMETER DEPENDENT ASYMMETRIC NON-AUTONOMOUS EQUATIONS

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Dedicated to Jean Mawhin on the occasion of his 60th birthday

Abstract. Using some recent results on the rotation numbers approach to the periodic problem, we obtain multiplicity of periodic solutions for the equation $x'' + f(t,x) = s\,w(t)$, when the parameter s is large.

Keywords. Periodic solutions, asymmetric equations, unbounded continuum of solution pairs, multiplicity results, rotation numbers, Poincaré - Birkhoff theorem.
AMS (MOS) subject classification: 34C25, 47H15.

1 Introduction and preliminary results

The study of boundary value problems for nonlinear ordinary and partial differential equations with asymmetric nonlinearities is a research topic which has been widely investigated starting with the pioneering work of Ambrosetti and Prodi [2]. Some classical results can be found in [3], [24], [27], [44], just to mention a few of them. Besides the interest in the rich phenomena arising from the presence of these nonlinear terms, also-called "jumping nonlinearities" and linked to the study of the Fučik spectrum [7], [17], various investigations were addressed in the recent years to the periodic boundary conditions. In this direction, researches were carried on both from the point of view of analyzing the Ambrosetti-Prodi problem for general classes of second order ODEs [14] and also toward the study of multiplicity results for harmonic and subharmonic solutions to some second order nonlinear equations connected to the Lazer-McKenna model for the oscillations in suspension bridges [28], [29].

In [8], del Pino, Manásevich and Murua, motivated by a previous work of Lazer and McKenna [28], proved the existence of $2n+2$ 2π-periodic solutions for the equation

$$u'' + f(u) = s(1 + h(t)), \tag{1.1}$$