



Analytic continuation in the case of non-regular dependency on a small parameter with an application to celestial mechanics

Josep M. Cors^{a,*}, Conxita Pinyol^{b,2}, Jaume Soler^{c,1}

^a*Departament de Matemàtica Aplicada III, Universitat Politècnica de Catalunya, 08240 Manresa, Spain*

^b*Departament d'Economia i Història Econòmica, Universitat Autònoma de Barcelona, 08193 Bellaterra, Spain*

^c*Departament d'IMA, Universitat de Girona, 17071 Girona, Spain*

Received 1 April 2004; revised 4 July 2005

Available online 10 October 2005

Abstract

We consider a non-autonomous system of ordinary differential equations. Assume that the time dependence is periodic with a very high frequency $1/\varepsilon$, where ε is a small parameter and differentiability with respect to the parameter is lost when ε equals zero. We derive from Arenstorf's implicit function theorem a set of conditions to show the existence of periodic solutions. These conditions look formally like the standard analytic continuation method, namely, checking that a certain minor does not vanish. We apply this result to show the existence of a new class of periodic orbits of very large radii in the three-dimensional elliptic restricted three-body problem for arbitrary values of the masses of the primaries.

© 2005 Elsevier Inc. All rights reserved.

Keywords: Continuation method; Averaging; Periodic orbits; Symmetric orbits; Spatial restricted three body problem

* Corresponding author. Fax: +34938777202.

E-mail address: cors@eupm.upc.es (J.M. Cors).

¹ Partially supported by DGES Grant number BFM 2002-04236-C02-02 and by CICYT Grant number 2001SGR 00173.

² Partially supported by CICYT Grant number SEC 2003-05112/ECO.