

Accepted Manuscript

Non-integrability of the minimum-time Kepler problem

M. Orieux, J.-B. Caillau, T. Combet, J. Féjoz

PII: S0393-0440(18)30430-3

DOI: <https://doi.org/10.1016/j.geomphys.2018.06.012>

Reference: GEOPHY 3248

To appear in: *Journal of Geometry and Physics*

Received date: 8 January 2018

Revised date: 17 June 2018

Accepted date: 28 June 2018

Please cite this article as: M. Orieux, J.-B. Caillau, T. Combet, J. Féjoz, Non-integrability of the minimum-time Kepler problem, *Journal of Geometry and Physics* (2018), <https://doi.org/10.1016/j.geomphys.2018.06.012>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



Non-integrability of the minimum-time Kepler problem[☆]

M. Orieux^a, J.-B. Caillau^b, T. Comboto^c, J. Féjoz^d

^a*CEREMADE, Univ. Paris Dauphine, Place du Maréchal de Lattre de Tassigny, F-75016 Paris
(orieux@ceremade.dauphine.fr)*

^b*LJAD, Univ. Côte d'Azur & CNRS/Inria, Parc Valrose, F-06108 Nice (caillau@unice.fr)*

^c*Institut math., UBFC & CNRS, 9 avenue Savary, F-21078 Dijon (thierry.combot@ubfc.fr)*

^d*CEREMADE, Univ. Paris Dauphine, Place du Maréchal de Lattre de Tassigny, F-75016 Paris
& IMCCE, Observatoire de Paris, 77 avenue Denfert Rochereau, F-75014 Paris
(jacques.fejoz@dauphine.fr)*

Abstract

We prove, using Moralès-Ramis theorem, that the minimum-time controlled Kepler problem is not meromorphically integrable in the Liouville sens on the Riemann surface of its Hamiltonian.

Keywords: Hamiltonian systems, integrability, differential Galois theory, optimal control, Kepler problem

1. Introduction

The Kepler problem

$$\ddot{q} + \frac{q}{\|q\|^3} = 0, \quad q \in \mathbb{R}^2 \setminus \{0\}. \quad (1)$$

is a classical reduction of the two-body problem [2]. Here, we think of q as the position of a spacecraft, and of the attraction as the action of the Earth. We are interested in controlling the transfer of the spacecraft from one Keplerian orbit towards another, in the plane. Denoting $v = \dot{q}$ the velocity, and the adjoint variables of q and v by p_q and p_v , the minimum time dynamics is a Hamiltonian system with

$$H(q, v, p_q, p_v) = p_q \cdot v - \frac{p_v \cdot q}{\|q\|^3} + \|p_v\|, \quad (2)$$

as is explained in section 2.1. Prior studies of this problem can be found in [6, 5]. The controlled Kepler problem can be embedded in the two parameter

[☆]Work supported in part by FMJH Program PGMO and from the support of EDF-Thalès-Orange (PGMO grant no. 2016-1753H)

Download English Version:

<https://daneshyari.com/en/article/8255517>

Download Persian Version:

<https://daneshyari.com/article/8255517>

[Daneshyari.com](https://daneshyari.com)