



Images/uab.pdf

BACHELOR THESIS

---

# Numerical propagation of trajectories of Earth-orbiting spacecraft

---

*Author:*

Víctor Ballester

*Supervisor:*

Josep Maria Mondelo

Bachelor's Degree in Mathematics

Departament de Matemàtiques

Facultat de Ciències

---

June 26, 2023

We are just an advanced breed of monkeys  
on a minor planet of a very average star.  
But we can understand the Universe. That  
makes us something very special.

---

*Stephen Hawking*



## Acknowledgements

I would not like to finish this project without thanking the people who have helped me along the way. First and foremost, I would like to thank my two supervisors, Professors Alexandros Alexakis and Emmanuel Dorny, for their guidance and constant support throughout the project. This project was, in the theoretical perspective, a bit far from my previous works, but their continuous help and advice made it possible. I would also like to thank the whole group led by Professor Stéphan Fauve in the Laboratoire de Physique de l'École Normale Supérieure, for giving me a desk and a place to work during my internship. Finally, I appreciate the huge amount of time and resources that both supercomputer centers, IDRIS and MESOPSL, have provided me with during the development of this project. Without their technology, this project would have been impossible to carry out.



# Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
<b>2</b>	<b>Conics in a nutshell</b>	<b>3</b>
<b>3</b>	<b>Introduction to astrodynamics and satellite tracking</b>	<b>5</b>
3.1	The two body problem . . . . .	5
3.1.1	Trajectory equation . . . . .	5
<b>4</b>	<b>Earth's gravitational field and other perturbations</b>	<b>7</b>
<b>5</b>	<b>Simulation</b>	<b>9</b>
5.1	Introduction . . . . .	9
	<b>References</b>	<b>11</b>





# 1 Introduction



## 2 Conics in a nutshell



### 3 Introduction to astrodynamics and satellite tracking

#### 3.1 The two body problem

##### 3.1.1 Trajectory equation



## 4 Earth's gravitational field and other perturbations





## 5 Simulation

### 5.1 Introduction





