

Numerical Methods for Dynamical System and Control

Course project

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1 Introduction

The project consists in carrying out the tasks given and record all the results in a **short** written report (10/20 pages), ideally using L^AT_EX (or LyX). Attention should be paid to:

1. Correctness of the results.
2. Presentation of the results and layout of the report.
3. Critical discussion of the results using the studied theory and course materials.

The contents of the report will then be discussed (orally) with the examiners, at which the student may be asked to explain details of the programs and to re-run some of the problems. The project is *individual* and counts towards 50% of the final mark. The project should be handed in electronic form (zip archive file) to the lecturers, calling the file: `surname_name_NMDSC2010_project.zip`. The archive must contain the project report (in pdf) and the related programs written in MATLAB/MAPLE. Other accepted programming languages are SCILAB, Octave, FORTRAN, C, C++ and BASIC.

2 The project

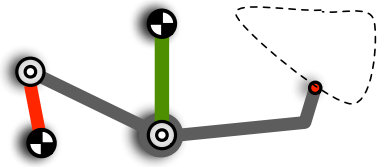
Consider one of the mechanism of Figure 1, the specific mechanism will be assigned in the following way. Take the first letter of surname, for example if you are Bartolomeo Pestalozzi the letter is P. Given the letter get the number from the corresponding column on the following table

1	2	3	4	5	6
A	B	C	D	E	F
G	H	I	J	K	L
M	N	O	P	Q	R
S	T	U	V	W	X
Y	Z				

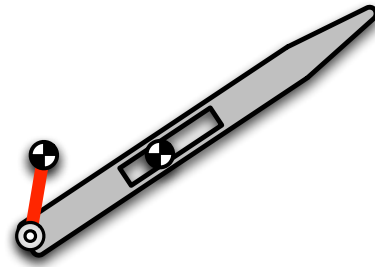
for example in this case the exercise is the number 1. For the assigned mechanism do the following task:

- Derive the DAE of the mechanism (it is strongly suggested the use of MAPLE with MBSymba library). Write the DAE in the report.
- Compute the differential index of the DAE.
- Write and implement implicit Euler or Taylor numerical scheme with Baumgarte stabilization.
- Only for the brave, write and implement coordinate partitioning numerical scheme.
- Estimate numerically the order of convergence for the implemented scheme.
- Plot and comment all the numerical solutions.
- Discuss the numerical difficulties.

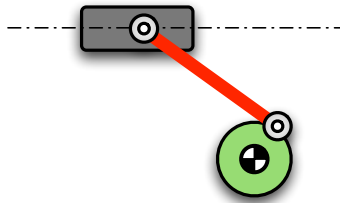
The mechanism do not contain dimensions or weights. The student should dimension the mechanisms with reasonable values.



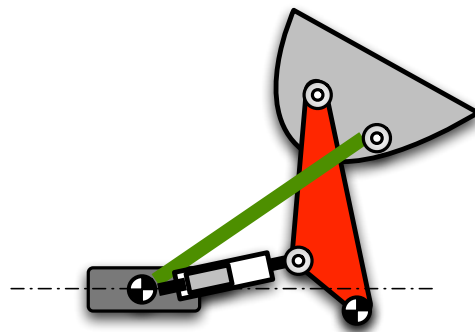
exercise n.1



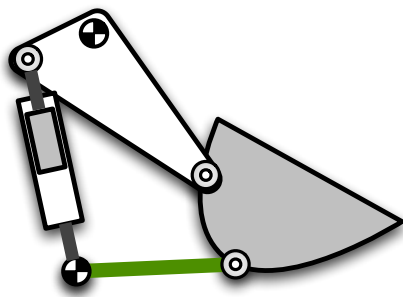
exercise n.2



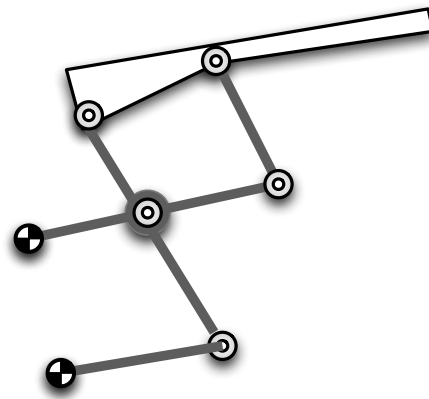
exercise n.3



exercise n.4



exercise n.5



exercise n.6

Figure 1: Mechanism for the assigned projects