

EML 5215

Exam 2

Fall 2015

8-9 December 2015

What Allowed During Examination

You may use any books, your personal notes, or electronic aid, provided that you find the material on your own without having it provided to you by anyone else (either implicitly or explicitly). You may not, under any circumstances, communicate with anyone about this exam.

Any violations of the exam rules will result in further action on my part in a manner consistent with the academic honesty policy of the University of Florida. The academic honesty policy can be found at the Student Conduct and Conflict Resolution website:

<https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>

Guidelines for Solutions

Communication is an extremely important part of demonstrating that you understand the material. To this end, the following guidelines are in effect for all problems on the examination:

1. Your handwriting must be neat. I will not try to decipher sloppy handwriting and will assume that something is incorrect if I am unable to read your handwriting.
2. Your test must be **HANDWRITTEN**, no software, no scans, etc., your own handwriting **ONLY**. If anything else appears other than your own handwriting, the test will be evaluated at 0 (zero).
3. You must be crystal clear with every step of your solution. In other words, any step in a derivation or statement you write must be unambiguous (i.e., have one and only one meaning). If it is ambiguous as to what you mean in a step, then I will assume the step is incorrect.
4. Tests without name on each page, and/or without UFID and signature at the bottom of this page, will not be graded, i.e., they will count as a 0 (zero).

In short, please write your solutions in an orderly fashion so that somebody else can make sense of what you are doing and saying. Finally, credit will be given only if a relevant concept is applied properly, and no credit will be given for an incorrectly applied concept even if the final answer is correct.

University of Florida Honor Code

On your exam you must state and sign the University of Florida honor pledge as follows:

On my honor, I have neither given nor received unauthorized aid in doing this examination.

Signature:

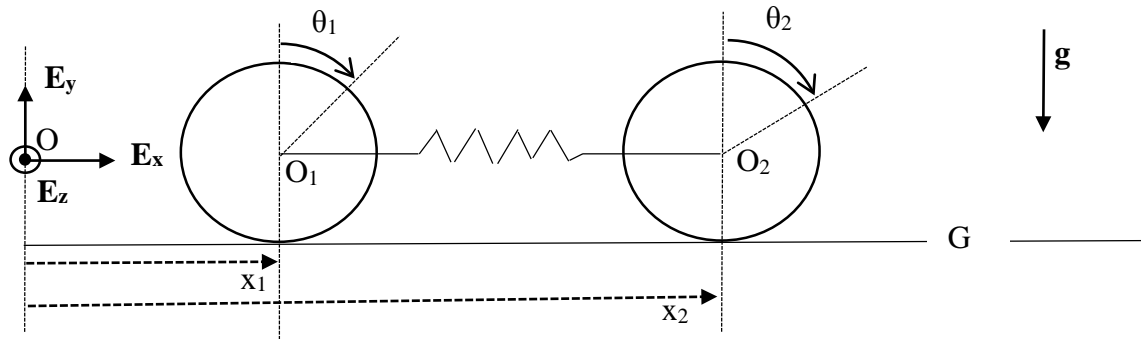
Date:

University of Florida ID:

TOTAL POINTS: 100

Question 1: 30 points

Two identical wheels of mass m , moment of inertia about the center of mass and axis of symmetry normal to the page I , and radius r , move on an inertial ground (G), under the influence of gravity and are connected by a linear spring of constant k and length at rest l_0 through their centers of mass (O_1 and O_2). They both roll on the ground. Consider $x_1(t=0)=0$, $x_2(t=0)=x_{20}$, $\theta_1(t=0)=0$, and $\theta_2(t=0)=0$. Find the equations of motion via Euler's Laws, using the variables θ_1 and θ_2 . Use the image below as additional aid to set up the problem, where the ground fixed coordinate system is already given.

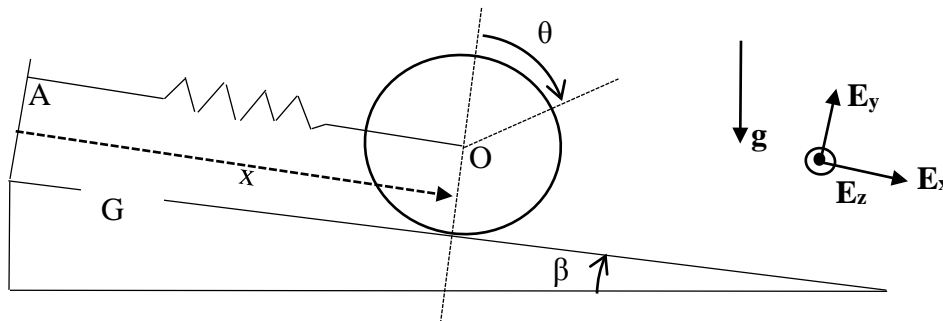


Question 2: 20 points

Solve the problem in question 1 using Lagrange's Equations.

Question 3: 30 points

One of the wheels in question 1 is now sliding on an inclined plane, considered inertial ground (G). The angle between the plane and the horizontal is β . The wheel is also under the influence of gravity, there is viscous friction with the ground (constant C), and the same spring of question 1 connects its center of mass to the ground at point A as in the image below. Find the equations of motion via Euler's Laws, using the variables θ and x . Use the image below as additional aid to set up the problem, where the ground fixed coordinate system is already given (E_x parallel to incline).



Question 4: 20 points

Solve the problem in question 3 using Lagrange's Equations.