Report and delivery of the results

You have to undertake the project with MATLAB and PYTHON and related libraries.The submission of the project report and the runnable Matlab and python files is done as a zip file .Please make sure that the files contained in the zip file are runnable (if necessary, ask a Tearn member to check this!). Result files that are created automatically during the run of Mathernatica and Matlab and python are not to be submitted - in particular, the created videos should not be uploaded as avi files.
- These will be recreated during a Matlab run of the submitted files. The zip file should contain a project report (documented Mathernatica file), a folder with the Matlab files (the Matlab file to be run should be named "rnain") and the Mathernatica file and python files.

The files are to be documented in a comprehensible manner, which is to be done in the form of grain comments in the program and correspondingly clearly labeled graphics. All variables used in the project report (masses, distances, forces, etc.) must be clearly recognizable in the graphic (sketch)!

1 Specification

The tribok *T* shown in Figure 1, which adheres to the ground in any state of motion, consists of the outlined structure with the cylindrical mass *K* (mass m_k) and the point mass P_1 (mass m_1). The cylindrical mass *K* is connected into the beam *B*. The point mass P_1 also serves as a projectile and is connected to the beam *B* by a rod at point *F*. *The beam B is* connected to the point *F* by a rodless rod. The beam *B is* articulated at point *D*. *The* rotational *damping* d_1 in the bearing should be taken into account.

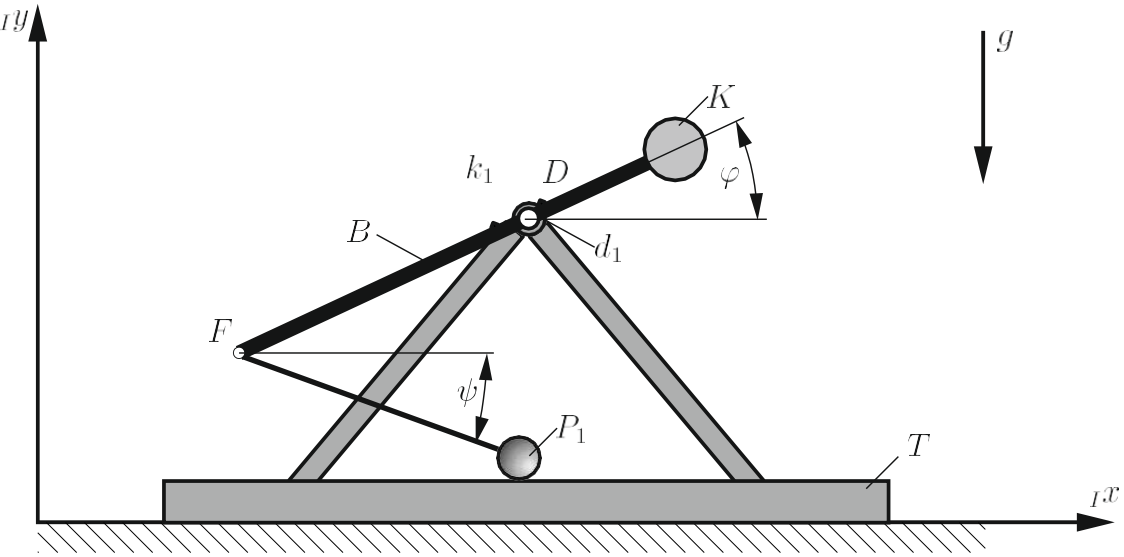

Figure 1: Sketch of the Tribok

The movement of the tribok *T* starts with a starting angle of φ_0 . With a launch angle of ψ^* the bullet is released. Furthermore, it can be assumed that the point wet P_1 slides smoothly along the drawn flat until it takes off.

2 Task

a) Set up the equation of motion of the tribok using Mathernatica.

- The following principles are to be applied:

  Newton - Euler method

  Principle according to Jourdain or principle according to d'Alernbert

Principle Lagrange 2nd kind

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- In the computational report, all three variants should be there.

b) Simulate the equation of motion in Matlab and python. The values of the Parameter are to be selectedthereby itself.

c) For the further tasks the model should be extended as shown in figure 2:

The tribok is placed on two wheels (mass m_R , mass load-bearing ΘR). Sliding is excluded in the rolling contact. The beam B is now considered to be wetted (mass m_B , mass moment of inertia ΘB). Furthermore, the cylindrical mass K *is* to be connected frictionless and articulated to the beam B at point E by a rod with mass (mass m_S , mass moment of inertia ΘS). Lifting of the wheels from the ground is excluded. In order to stimulate the tensioning process, the beam is loaded with a constant M_{Spann} up to the time t_{Spann} , which then abruptly becomes 0.

The changes can be seen in Figure 2.

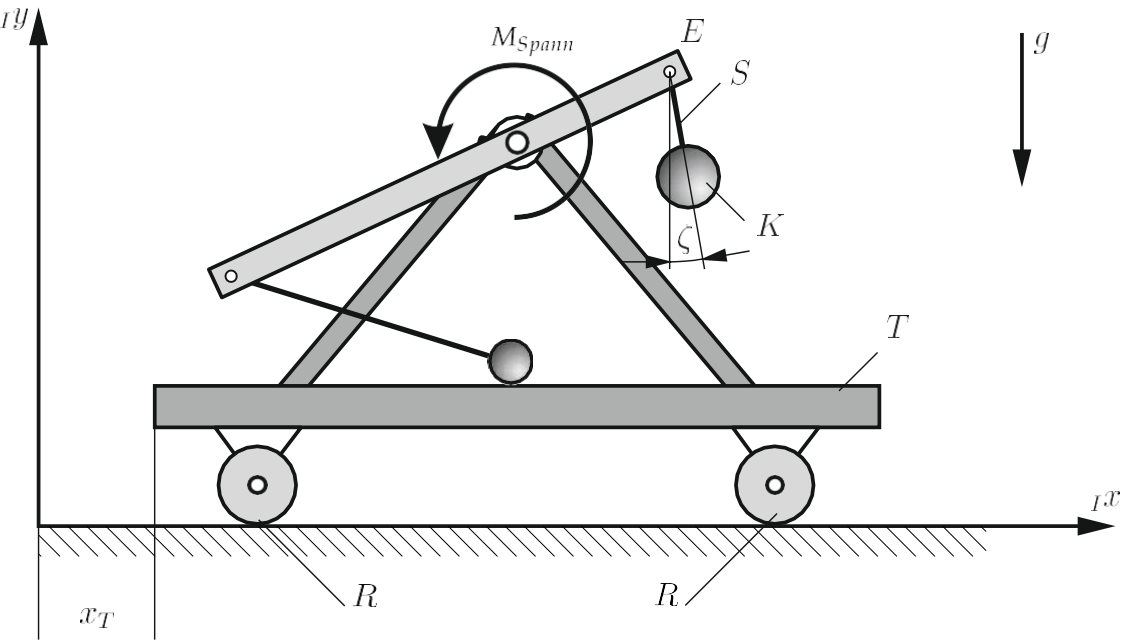

Figure 2: Sketch of the Tribok after extension of the model requirements.

Set up the equation of motion of the modified model using Mathematica.

d) Simulate the set up in c) in Matlab and python. The values of the parameters are to be chosen by yourself.

e) Examine the movement behavior of the System in more detail, idem you vary Parameter. Try to answer the following questions:

- How does the model behave when the parameters change?
- Which parameters particularly influence the behavior of the system?
- Is the energy of the system constant and if so, why?

f) All numeric results are to be evaluated graphically, videos are to be created in Matlab for the motion sequence. The drop angle ψ^* is to be determined and displayed in the video.