

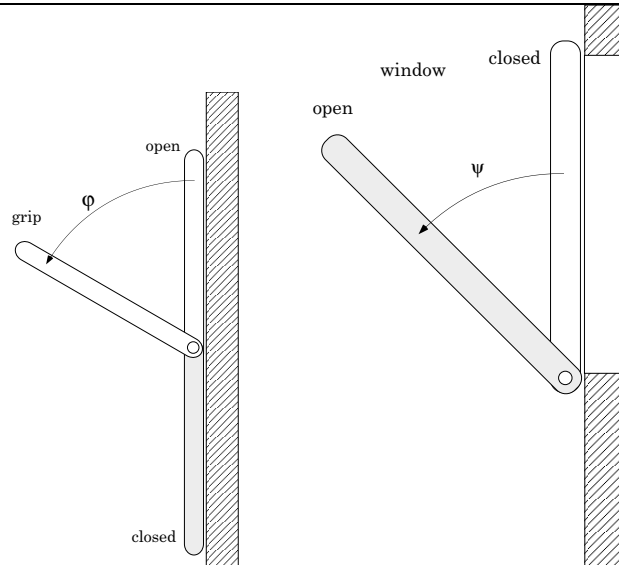
Description of Problem:

Window-Drive

System-Input: Grip movement

System-Output: Window movement

A window 5 m higher than the grip to open it should be driven by a mechanism - rigidly connected. For a window movement of 45° between open and closed position the grip should have a rotation of 180° (or more if necessary). In the closed position the grip should lock the window. Length of window $l_W = 0.9$ m, length of grip $l_G = 0.24$ m, mass of window $m_W = 70$ kg (CM in the middle of the window). The transmission angle should always greater than 25° .



Solve: <proposed credit points>

- 1) <4> Select a type of mechanism to drive the window meeting the requirements

Note, the transmission rod from the grip to the window mechanism should be placed closed the wall.

- 2) <28> Find the corresponding parameters of the mechanism
 - a) by a numerical solution (using any Math programs),
 - b) verify the results by a graphical method (or opposite);
 - c) with the results check all the requirements ;
 - d) check the locked situation.

- 3) <6> Derive the equations of the output angle ψ_W as function of the grip angle ϕ_G and plot it.

- 4) <6> Find the functions for toggle angles, transmission angle, etc. and plot it.

- 5) <6> Find the function of the grip torque M_G as function of the grip angle ϕ_G using the Jourdain's principle (balance of power) for a gravitational force of a window and the locking torque of a ramp from 0 to 15 Nm during the last 3 degrees window rotation before closed. Assume that no further forces and torques exist.

Basic Restrictions:

1) Write the following header on the top of the report and all the files:

MFB470-MDA-SS2009-Project1

Problem 1 - Group xx

Personal No. o List	Fam. Name	First Name	Stud. Group	Mat.-No.

Please add lines for each user of the group.

- 2) A group has maximum 2 persons. The groups are defined before handout and can not changed later.
- 3) I want to get a report in paper form, simple fixed. The report contains definition of the project (task), derivation of equations, drawings, diagrams, main results.
Handwriting is possible. One group has one report.
Hand over must be in time and in the post case near the faculty office.
- 4) Additionally, I want a folder (compressed by zip) containing all files of mathematical calculations done by math programs send by mail to Wallrapp@hm.edu.
Mail-Subject: MDA_Pro1_Problem1_Groupxx << very important.
File-Name: MDA_Pro1_Problem1_Groupxx.extension << very important -
other files are not accepted!
Never use "Umlaute" in the text and file name !!!
- 5) The project is a part of the exam in MDA and will be valid by points / later by a mark. Each user in a group will get the same mark. The proposed points are given in the task description. The maximum is 50 points.