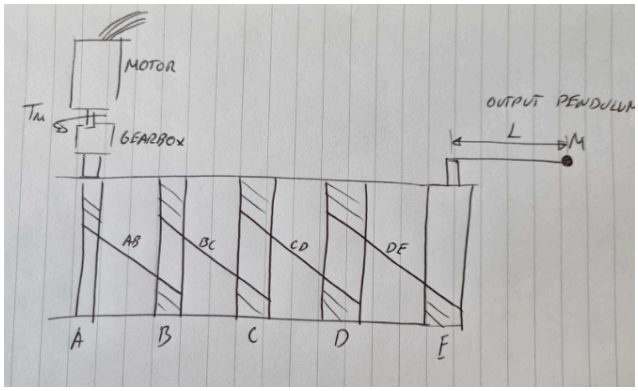
Assignment 1

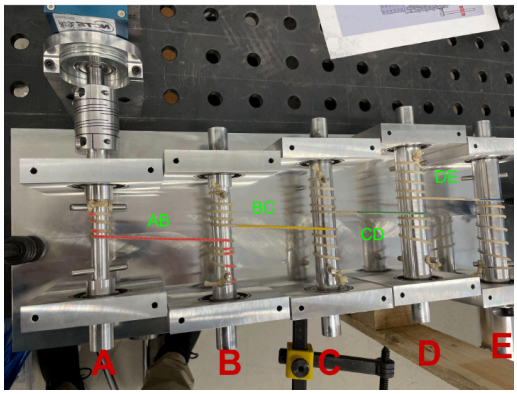
Task: Design a test bed that can measure and record the output torque of a frameless motor (ILM-E85x30 from TQ-group - https://www.tq-group.com/en/products/tq-robodrive/servo-kits/ilm-e85x30/). Feel free to use any off the shelf components that aid your design (measurements devices, actuators etc.). Don't worry about integrating any electronics or routing power etc.

Questions/Exercises:

I. A Solidworks assembly of your design.
II. A brief outline of the test procedure for mounting a test motor and measuring the output torque for varying desired torques.
III. Drawings are not required but provide a description of critical features in your design for fitment alignment etc.
IV. An assessment of the limits of your design. What are critical considerations in getting accurate data? At what point can you no longer trust your data?

Assignment 2





- In the next picture, you can see a testbed used to find out the number of cycles for the ropes we use in our robot transmission system
- The motor output is connected to a gear box for further increase of torque. The output of the gearbox is directly connected to the shaft A.
- The bar of the output pendulum should be considered as zero mass and length L=0.3m. The point load mass at the end of the pendulum is M=2kg. This output pendulum is directly connected to shaft E.
- The motor turns shaft A, which makes the rope AB ”pull” the shaft B. By pulling the shaft B, the rope BC tensions and “pulls” the shaft C… and so on. As the load is connected to the shaft E, you can think of the system as a set of reduction stages from the motor to the load where every shaft is a stage.
- The diameter of the shafts are: Da=20mm, Db=30mm, Dc=40mm, Dd=50mm, De=65mm.
- Questions/Exercises:
    i. Calculate each rope load (Fab, Fbc, Fcd, Fde) when the output pendulum is completely horizontal and static (holding torque). Neglect any mechanical losses.

ii. Calculate torque of the motor (Tm) and gearbox gear ratio of 10:1 when the output pendulum is completely horizontal and static (holding torque). Neglect any mechanical losses.
iii. Draw a simple electrical set-up with the necessary components needed to run the testbed. For this task, consider the selected motor being https://en.nanotec.com/products/650-db87m01-s. Also, the testbed needs to be position controlled.
iv. Write a simple script in C++ that cycles load. The pendulum should go from completely horizontal (0 degrees) to completely vertical (90 degrees), and vice versa, without stopping.