

**Warsaw University of Technology**  
**Faculty of Mechatronics**

Theory of Machines and Devices

**Project 03**

Report

Kinematic analysis of a Laboratory Stirrer

Made by:

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## 1. Mechanism Synthesis

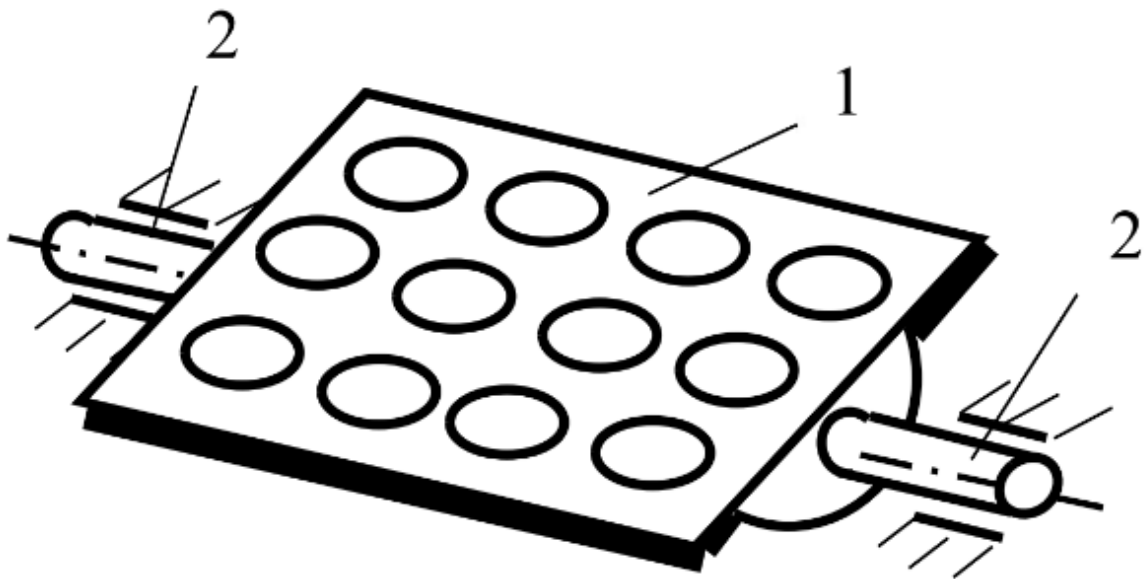


Figure-1.1 Stirrer table mounted on bearings.

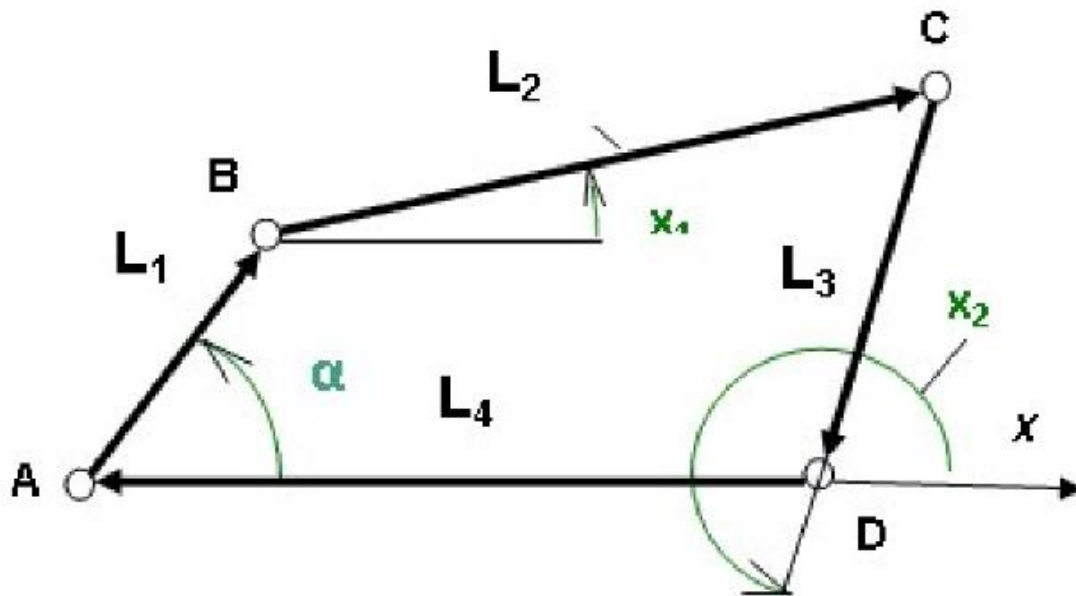


Figure-1.2 Schematic of stirrer drive

## 2. Course of the exercise

In this exercise, we are going to perform kinematic analysis of a Laboratory Stirrer.

We have to implement the task in two stages:

Firstly, selecting the dimensions of the mechanism with the imposed structure and carrying out the necessary calculations to provide data for determining the reactions in the kinematic pairs.

Secondly, Calculation of dynamic loads in the stirrer drive mechanism.

Values assigned			
No.	$\Phi_{\max}$	$\omega$	m
15	12	25	0,4

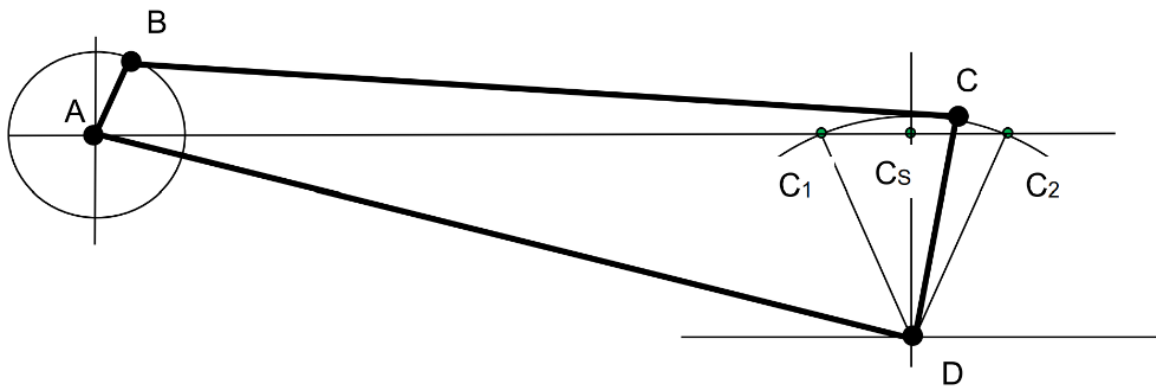
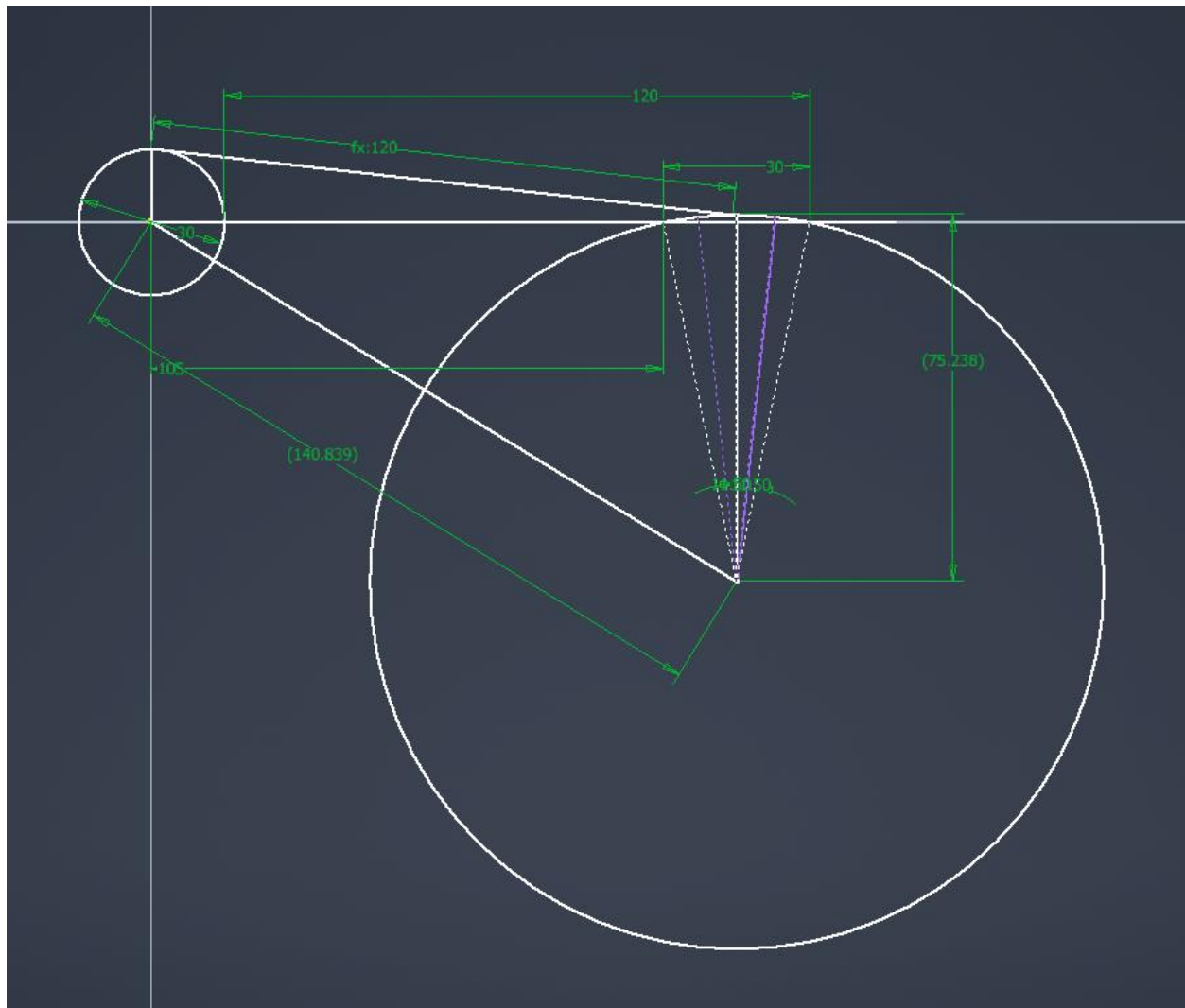


Figure-2.1 Diagrammatic synthesis of the mechanism

### 3. Schematic of the Design in Inventor

We achieve this design by using the given values and further adjusting the design.



*Figure-3.1 Schematic of the Design*

#### 4. Maximum deformation on the part

While almost all parts exhibit some deformation, the maximum deformed part was observed to be the shank connecting the lever to motor.

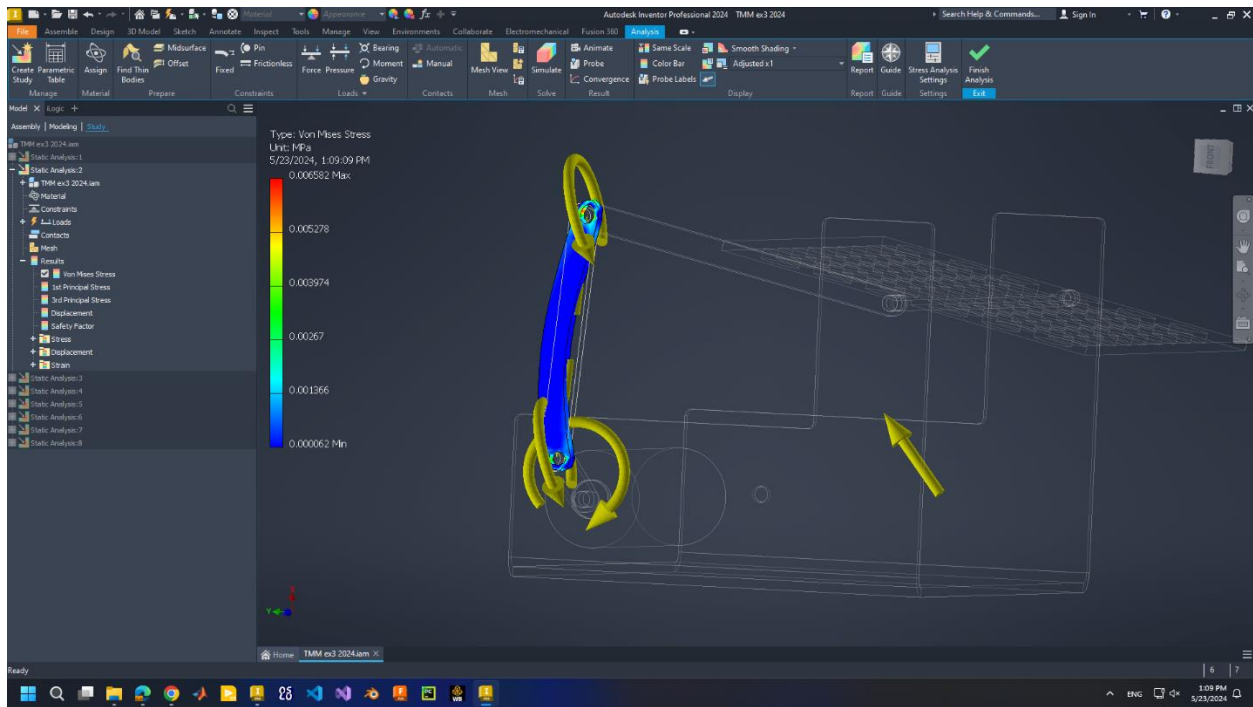


Figure-4.1 Shank experiencing maximum deformation.

## 5. Comparison of Inventor Output Grapher

We compare Moments on Welding: 4 and Revolution : 5. The Highest values recorded were observed as follows:

Welding: 4	Revolution: 5
15.53170	11.40570

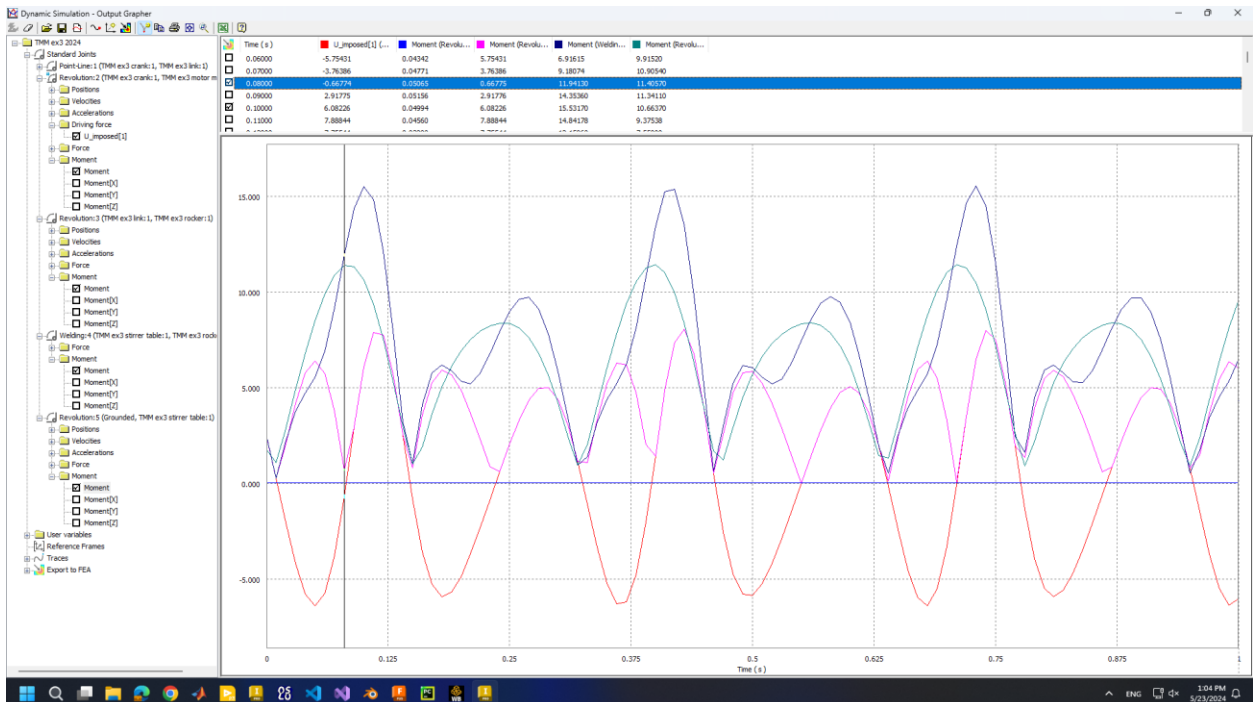


Figure-5.2 Plot presenting position of the shank, lever and table over multiple revolutions.

## 6. Conclusions

- **Effect of Rounding Link Lengths:** Rounding link lengths to natural numbers introduced slight variations in the kinematic behavior of the stirrer. While small adjustments might not significantly impact the overall function, they can affect the amplitude of rocking. In my case, the length of the rounding link was changed only by a minimal amount, which did not change the outcome of the rocker.
- **Most Loaded Link Selection:** The identification of the most loaded link was done on an analysis of the forces and moments acting on each link during operation. When stress simulation was observed on the stirrer, maximum deformations were viewed by the User on each part of the stirrer. It was concluded that the Shank experiences the most deformation and thus it is the most loaded link of the system.