KDM Assignment 3

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1 Introduction

This document presents the velocity, acceleration, and displacement analysis of a knife edge follower system subjected to constant angular velocity. The simulations were carried out using **MSC Adams**, a multi-body dynamics simulation software. The simulation results have been compared with the original theoretical calculations, showing excellent agreement in each case. I have only provided simulation results for two particular gears that are the key and the drum, the purpose of this was to avoid the redundancy in graphs with linear slopes as well as the follower displacement diagram.

2 Angular Velocity Diagram

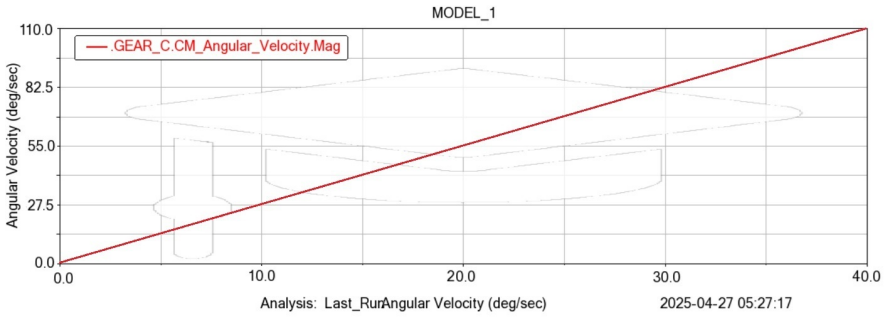

Figure 1: Angular Velocity of gear C vs Angular Velocity of gear A graph obtained from Adams simulation.

The angular velocity plot between gears A and gears C shows a constant ratio between their angular velocities, where the ratio is the gear ratio of 2.75 as calculated earlier. These results match well with the original analytical calculations.

3 Angular Acceleration Diagram

The angular acceleration plot between gears A and gears C shows a constant ratio between their angular accelerations, where the ratio is the gear ratio of 2.75 as calculated earlier. These results match well with the original analytical calculations.

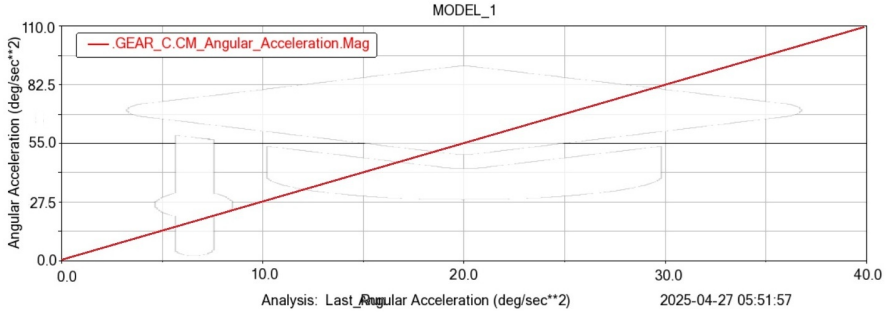

Figure 2: Angular Acceleration of gear C vs Angular Acceleration of gear A graph from Adams simulation.

4 Simple Harmonic Motion of Knife Edge Follower

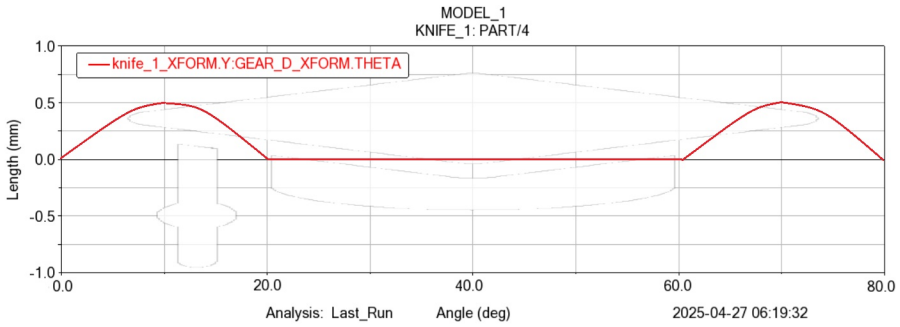

Figure 3: Displacement of Knife Edge Follower vs Cam Angle.

The displacement plot of the knife edge follower shows simple harmonic motion, varying sinusoidally with the cam angle. This behavior is characteristic of an ideal cam-follower system and matches closely with the original hand calculations.

5 CAD Simulation Proof

In addition to Adams simulations, CAD models were developed to visualize and verify the mechanical configuration and gear interactions. The CAD simulation further validates that the theoretical modeling matches the actual mechanical design.

These CAD simulations demonstrate that the mechanical design precisely replicates the intended motion profiles and gear ratios. The visual validation matches well with both Adams simulation results and the original theoretical calculations.

6 Conclusion

The simulation results from Adams were compared against original theoretical calculations for angular velocity, angular acceleration, and follower displacement. In all cases, the results showed excellent agreement, validating the modeling and simulation approach. Furthermore, CAD simulations confirmed the correctness of the mechanical design, providing additional proof that the original analytical models were accurate.

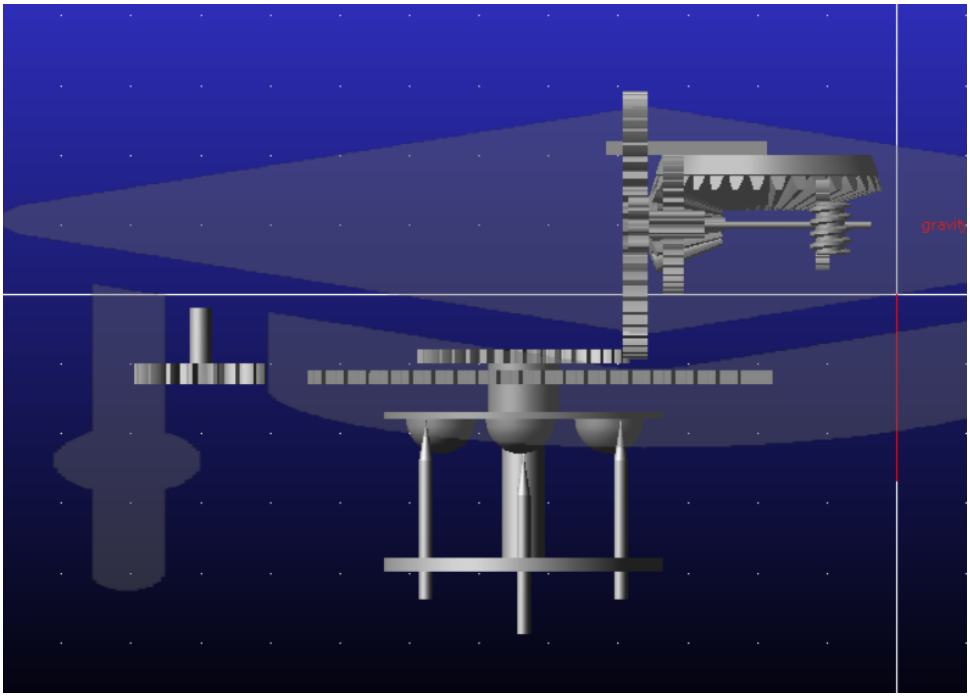

Figure 4: CAD model assembly imported into Adams Software.

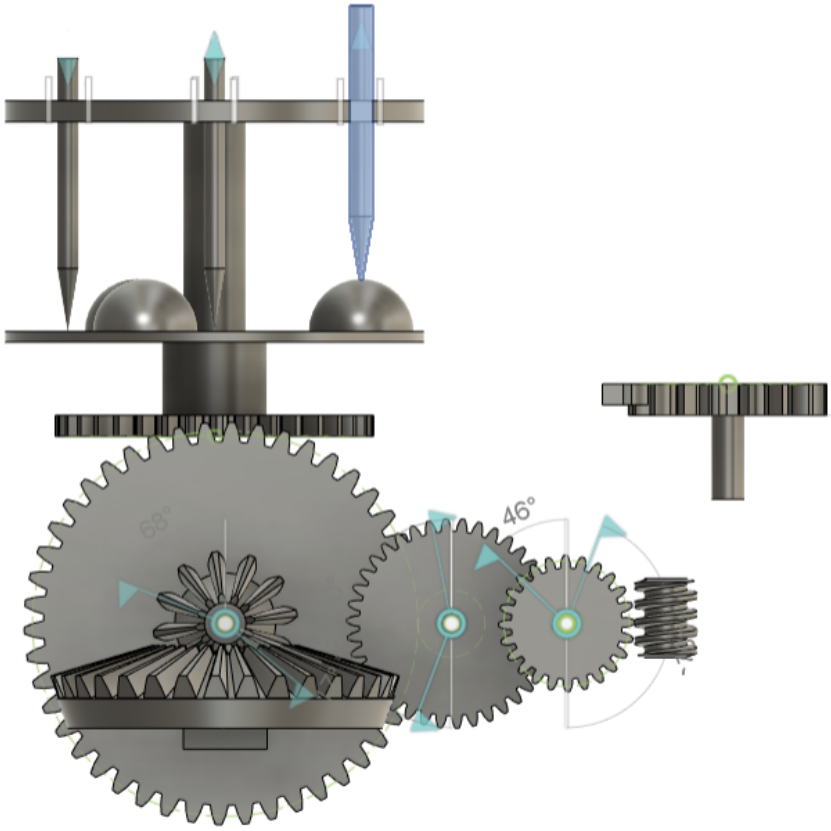

Figure 5: Detailed CAD assembly of the gear train and follower mechanism.

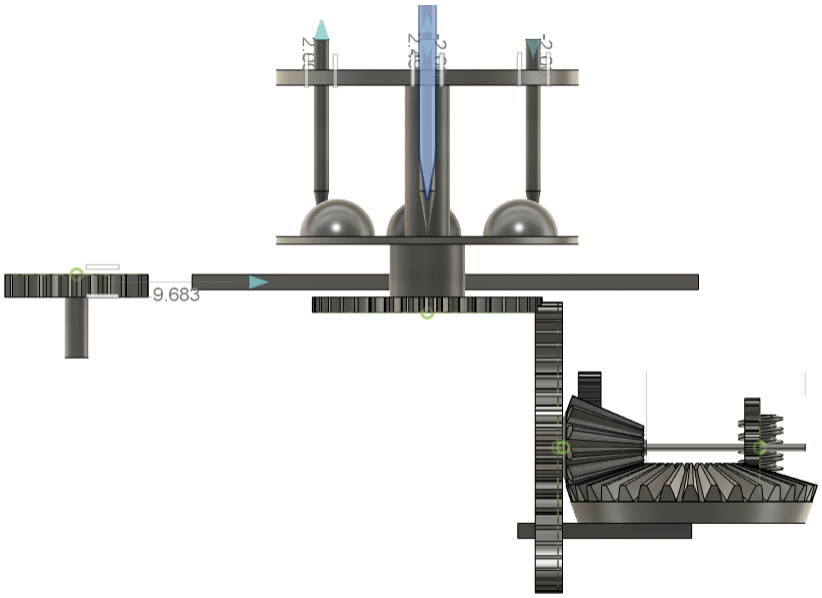

Figure 6: Side view of the CAD model highlighting bevel gear interaction.

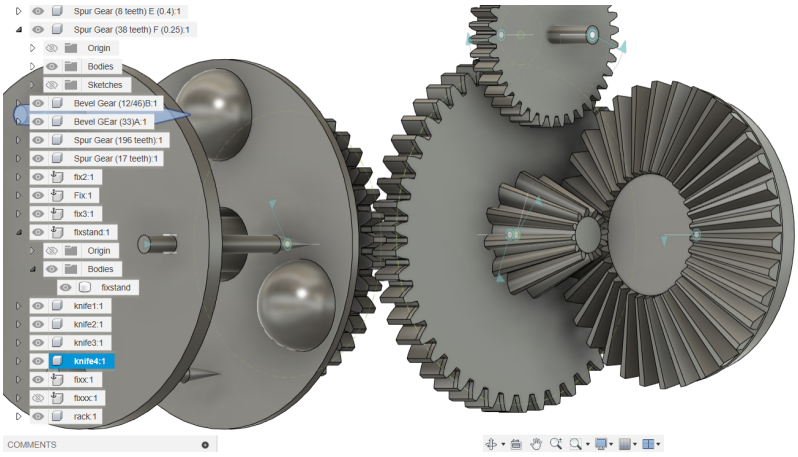

Figure 7: Close-up view of meshing gears.