

ECE 5390 Practicum Assignment 7a
Equivalent Gear Train Model

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I. Introduction

Practicum 7 explores mathematically modeling a real gear train from a motor exposed to the class.

The rest of this report is organized as follows. Section 2 covers the derivation of gear ratios, angular position, and angular speed.

II. Deriving Equations for the System

The motor box featured a gear train system as modeled in **Figure 1**. The equivalent gear ratio can be derived as:

$$N_{EQ} = \frac{N_2}{N_1} \cdot \frac{N_3}{N_4}$$

The data in **Table 1** can be used to determine the equivalent gear ratio

$N_{EQ} = 10:1$. The equivalent ratio can be used to determine the output angular position as well:

$$\theta_{OUT} = \frac{\theta_M}{N_{EQ}} = \frac{\theta_M}{10}$$

Finally, considering the angular speed $\omega = \dot{\theta}$:

$$\omega_{OUT} = \frac{\omega_M}{10}$$

Table 1: Experimental data

Gear Section	Teeth
N ₁	9
N ₂	24
N ₃	7
N ₄	26

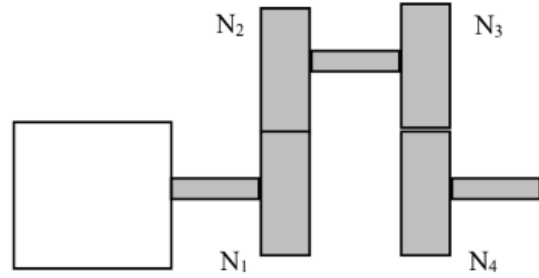


Fig. 1: Gear train model

III. Discussion and Conclusion

Practicum 7 is a good introduction to basic gear trains and discusses all pertinent measurable aspects excluding torque, which is only another simple derivation.