A LINEAR TIME-PERIODIC PLANT MODEL FOR IDENTIFICATION AND CONTROL OF PERIODIC MOTION

(GROUP LTP PLANT)

BENGİSU ADSIZ, DEMET ÇALIŞKAN

Supervisor

DR. İSMAİL UYANIK

Electrical and Electronics Engineering, Hacettepe University

INTRODUCTION

- This projects aim is to study system identification and control of linear time periodic systems.
- Key feature of this prototype is to ensure the robustness of the stability degree of the control loop at the time of a re-parametrization of the plant.

SPECIFICATIONS AND DESIGN REQUIREMENTS

- In this design each motor rotates a disk on which equal weight load are mounted. To test the prototype test bench should have behave as an LTP system. For the prototype to behave as an LTP system, motor 1 is supplied by periodic voltage of the form $u_1(t) = Ku(t)$, where motor 2 is supplied by periodic voltage of the form

$$u_2(t) = -(A_0 + A_1 \cos(w_0 t))\dot{\theta}(t)$$

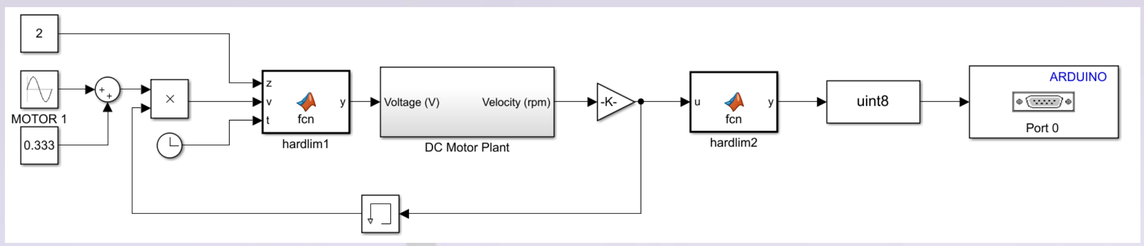
$$A_0 = 0.333\,, A_1 = 0.2\,, w_0 = 1\, rad/sec$$

$$u_1(t) = \mathrm{K}\cos(w_1 t)$$

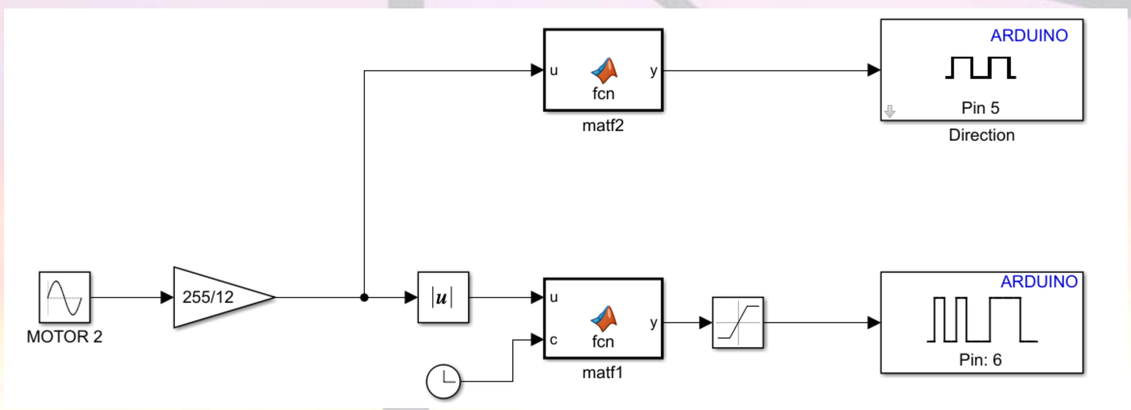
$$K = 0.2\,, w_1 = 0.2\, rad/sec$$

SOLUTION METHODOLOGY

- This prototype aims to develop a system with a linear time-periodic test bench.
- Main purpose of using this test bench is collecting data with MATLAB/Simulink to observe velocity and position parameters.
- To carry our plans through to completion, we have made a system including two coupled DC motors.



- One of these motors is controlled with Arduino UNO microcontroller by sending a Linear Time Periodic signal. This microcontroller is connected to a motor driver.
- Also, the second motor that is also connected to motor driver has a feedback with velocity and acts as a load. We would like to observe the effect of this load on the first motor.



REFERENCES

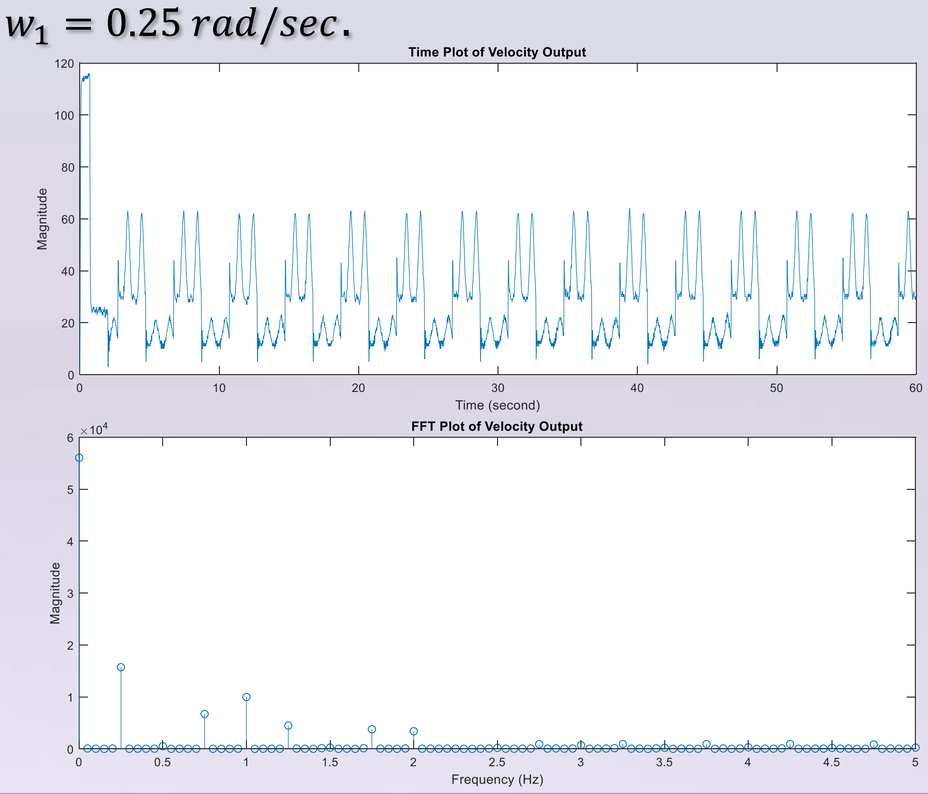
- Jocelyn S, Alain O, Aitor G. I, François L (2002) "CRONE control of continuous linear time periodic systems: Application to a testing bench", 33405 Talence cedex, France

APPLICATION AREAS

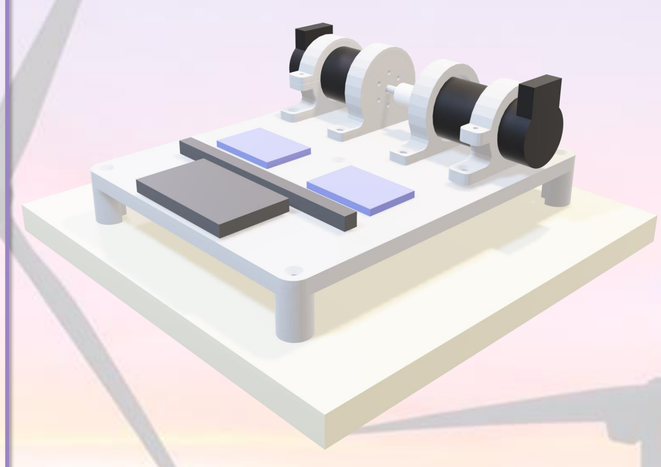
- Time-dependent periodic system dynamics are frequently confronted in nature and in engineering applications. Wind turbines, rotor tilt systems, power distribution networks, and walking / running behaviors of human and animals are examples of periodic systems that are frequently confronted and increasingly used.

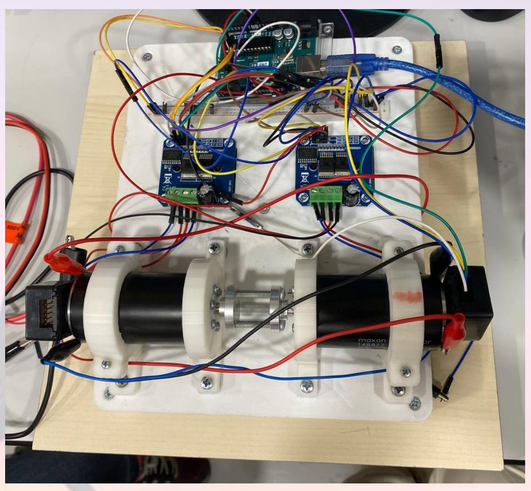
RESULTS AND DISCUSSION

- We tested our system with 5 different angular velocities values that we applied to the load motor.
- 1st graph is the time plot of the velocity data, 2nd graph is the Fourier Transform of the velocity output at $w_1 = 0.25\, rad/sec$.



FINAL DESIGN





ACKNOWLEDGEMENTS

- This project was completed within the context of ELE401-402 Graduation Project courses in Hacettepe University, Faculty of Engineering, Department of Electrical and Electronics Engineering.
- We thank İSMAİL UYANIK for his invaluable contributions to our project and endless patience to us.