

Department of Mechanical Engineering  
Cleveland State University

MCE 503: Modeling and Simulation of Mechatronic Systems  
Homework 1 - Spring 2009

**OUT: 01-27-09. DUE\*: 02-03-09 during class. No homework will be accepted past the due date and time.**

1. (20 pts) Find an article of your choice in one of the journals listed below (all available through the CSU library/OhioLink). The article must be related to mechatronics. Upon doubt, check with the instructor.

1. IEEE/ASME Transactions of Mechatronics
2. Journal of Intelligent Materials, Systems and Structures
3. Mechatronics
4. Journal of Dynamic Systems, Measurements and Control

Read it and write your own version of the abstract (about 200 to 300 words). Be sure to include the complete citation (authors, volume, year, pages) in your paper. Then prepare one or two pdf slides (please export PPT to PDF!) summarizing what is being done in the paper:

- Does the paper deliver theoretical, computational or experimental results? Is a new design proposed?
- Which technical needs are met with the results described in the paper?
- What remains to be done? Think about interesting extensions of the paper.

Be prepared to give a 5-minute presentation on your chosen paper to the class. A few students will be randomly chosen.

2. (80 pts) Consider the grain mill system depicted in the figure. The stone can be raised or lowered with the hydraulic piston, which receives hydraulic fluid from a pump. The details of the valving required to raise or lower the piston are not shown, but are irrelevant. An AC motor drives a set of gears intended to reduce speed. The large gear is attached to the stone. A transformer is used to adjust the voltage of the grid to the value required by the grind motor. The pump is directly driven from the AC motor, which is connected directly to the AC grid.

- a. Assume that the two AC sources are separate and draw a word bond graph for the system, propagating causality as far as possible.
- b. Suppose that the torque of the pump is a function of output pressure alone. Use this information to improve the causality assignment.
- c. Suppose that the grinding torque depends on the clearance between the stones and on the rotational speed. Which element (R, C, or I) can be included in the bond graph? Show how you would include it. *Hint: use a modulated element to capture the dependence on clearance.*

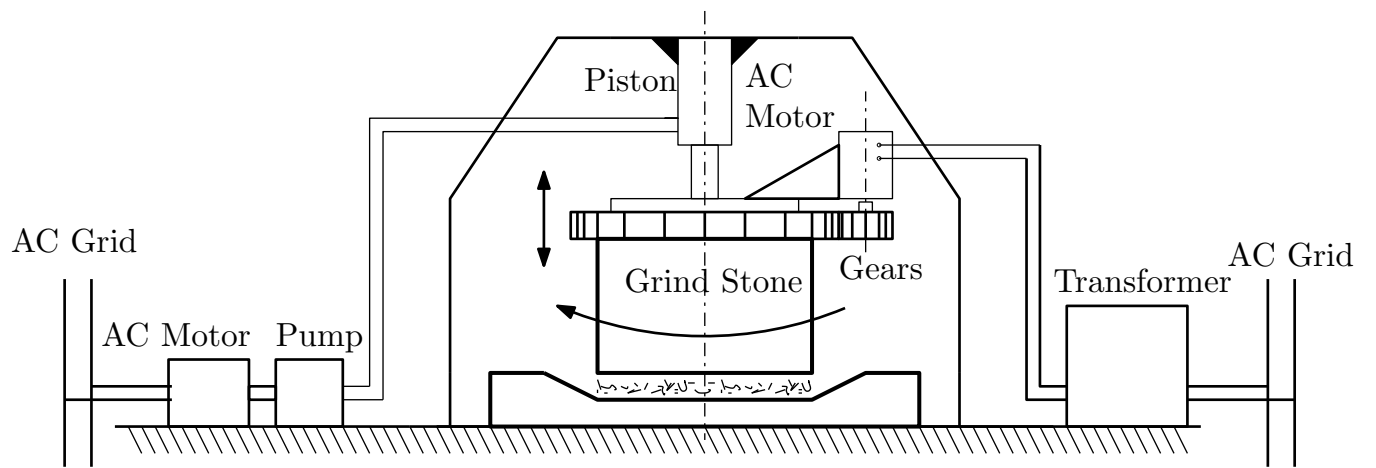


Figure 1: Schematic of the grain grinding system