



# Design of Harvesting Machinery

(Autumn 2025)

Instructor: [H. Golpira](#)

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## Course Description and Objectives

It deals with the fundamentals of the grain combine harvester's design and performance. A brief discussion is also performed on fruit shakers and autonomous harvesters. Finally, it discusses computer-aided design approaches for improvements of equipment. As the instructor's research was focused on the design of a chickpea harvester header, the course mainly tries to discuss the functional operators through his papers.

## Topics Covered

1. Field evaluation of harvesting losses in grain combine harvesters
2. Trailer axis design
3. Kinematic design of the reel
4. Sinusoidal trajectory of cyclic functional operators (rotary and drum mowers, reel, thresher ...)
5. Conventional and rotary grain combine harvesters
6. Thresher and concave (a stress design approach)
7. Terminal velocity and drag coefficient for cleaning systems
8. Physical, aerodynamic, and mechanical properties of grains
9. Computer-aided design of a stripper platform
10. Vibration mode for mechanical harvesting of fruits

## Homework/Assignments

The course assignments will be performed throughout the semester. You will provide a written report.

1. Homework 1: discusses autonomous harvesters for a fruit.
2. Homework 2: calculating drag coefficient, force, and terminal velocity for chickpeas
3. Homework 3: design of a rotary threshing system for soybean



## References

- [1] Golpira H, Golpira H, 2017. *Soft simulator for redesigning of a chickpea harvester header*, *Computers and Electronics in Agriculture*, 135(4): 252-259.
- [2] Golpira H, Tavakoli T and Baerdemaeker JD. 2013. *Design and development of a chickpea stripper harvester*. *Spanish Journal of Agricultural Research*, 11(4): 929-934.
- [3] Golpira H, 2013. *Conceptual design of a chickpea harvesting header*. *Spanish Journal of Agricultural Research*, 11(3): 635-641
- [4] Golpira, H, 2015. *Redesign and evaluation of a chickpea harvester*, *Journal of Biosystems Engineering*, 40(2):102-109.
- [5] Golpira H, Tavakoli T, Khoshtagaza MH, Minaei S, 2009. *Determining some mechanical properties of chickpea to use in the design of its harvesting machines*. *Agricultural Science*, 19(2): 24-33
- [6] Golpira, H., Rovira-Más, F., Golpîra, H., & Saiz-Rubio, V. (2021). *Mathematical model-based redesign of chickpea harvester reel*. *Spanish Journal of Agricultural Research*, 19(1), e0203-e0203.
- [7] Golpira, H., & Sola-Guirado, R. R. (2022). *Data-driven simulator: Redesign of chickpea harvester reels*. *Agriculture*, 12(2), 264.
- [8] Golpira, H., & Loghavi, M. (2022). *Vibration Mode for Effective Mechanical Harvesting of Shengy Olive*. *Journal of Agricultural Machinery*, 12(1).
- [9] Holden, N. M., Wolfe, M. L., Ogejo, J. A., & Cummins, E. J. (2021). *Introduction to biosystems engineering*. In *Introduction to Biosystems Engineering* (p. 0). American Society of Agricultural and Biological Engineers. [Grain Harvest and Handling](#)

## Grading

- Homework: 25%
- Final Exam: 50%
- Midterm: 25%