

I02081: Team F P-A-1 Assignment

A more effective pressure sprayer

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Authored by: The Modelling Team

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A more effective pressure sprayer

Gardena® GmbH, located in Ulm (Germany), is a manufacturer of gardening tools and a market leader in Europe. Gardena® needs to quantify their claim regarding the performance (release the largest possible quantity of water when the valve is completely open in one “full charge”) of their pressure sprayer (‘drukspuit’ in Dutch). They have asked you to help them do so and give advice on the design as well, especially on velocity of the flow and the ratio between water and air inside the barrel. More fundamental understanding is needed, complete with actual (measured) values for pressure, flow rate, etc.



Courtesy of www.gardena.com

Suggested steps (general)

1. Think – how does it work? (cause – effect);
2. Thought simulation, what parameters do you need to model its operation? Can you find the input via research or measurements?
3. Draft a time-dependent abstract model, either on paper or on Maple®, and list your own assumptions;
4. Set up an experiment to:
 - a. Find the unknown parameters (if available);
 - b. Verify the draft abstract model;
5. Finish your abstract model in Maple® or any tools which are necessary;
6. Verify it with your own thoughts and verify it with another experiment, this time under different conditions;
7. Evaluate it (and advise on improvement of the design), and point out the sources of discrepancies between your models and your measurements.

Setting up your experiment (practical)

For your measurements, the following items are available:

1. Product (a pressure sprayer) with a safety valve installed on top of it;
2. Camera (bring your own or borrow one at the Service Desk);
3. Other measuring tools (for volume, length, time (your mobile phone?)).

Set up your experiment goals, strategy and steps well in advance, since the time and space in the lab is limited.

Suggestions:

1. Use the abstract & concrete knowledge you acquired in the lectures;
2. Use the camera to determine the mass flow rate;
3. Keep the floor dry all the time, and clean up afterwards.

Hand in:

1. Report – No more than 15 pages, featuring:
 - a. A logical order;
 - b. Descriptions: each steps in the modeling cycle as applied to your assignment and your actions;
 - c. Abstract model with Maple file; Results of abstract model with the comparisons of the experiments; New designs(possible); What can Gardena® claim in the user manual?
 - d. Conclusions & Recommendations.
2. Presentations.