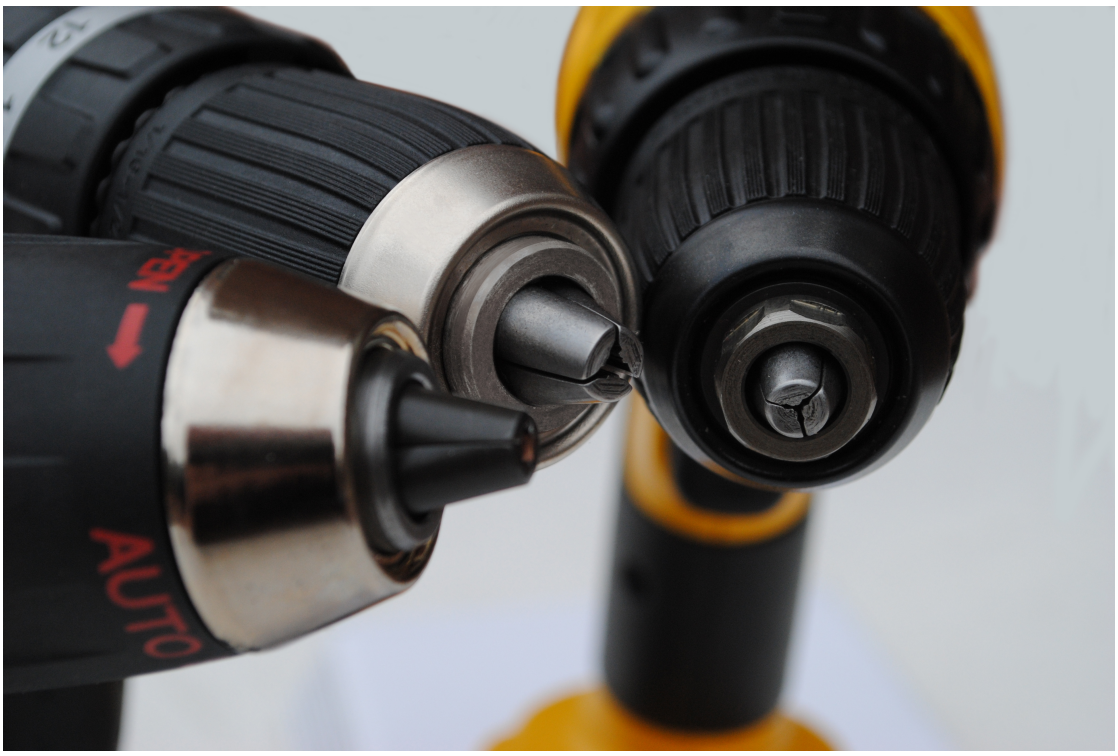

Semester Task

Systematic Product Development

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April 16, 2021

Contents

Table 1: Point Distribution

Component	Points
1st submission of project report	10
2nd submission of project report	25
Presentation of project results	15
Digital examination	50
Sum	**100**

1 About this document

This document serves as a consolidated description of the things in the course "Systematic Product Development" (SPD) that are relevant to grading. It contains information on how grades are calculated as well as the official documentation of the group task. While we aim to keep the defintion of the task consistent throughout the semester, this is a "living document" into which the clarifications made in response to your questions will be incorporated. Its version history is maintained on GitHub[1].

2 Grading

2.1 Exam Components

The exam is composed of four different components. Three of these (presentation, 1st and 2nd project report) are conducted in groups, the final exam is conducted individually. The weighing of these components is shown in table 1.

2.1.1 Project Report

The task for the project report is explained in detail in chapter 3.

2.1.2 Presentation of Project Results

Presentation – a little bit like in EnWiNaP, focusing on the unique features of each solution rather than each group showing the same thing. Perhaps each group focuses on one topic like cost, morphological box etc.?

[1] `https://github.com/mpm-tu-berlin/lehre-spd`

Table 2: Grading Scale

Points	Grade
≥ 95	1,0
≥ 90	1,3
≥ 85	1,7
≥ 80	2,0
≥ 75	2,3
≥ 70	2,7
≥ 65	3,0
≥ 60	3,3
≥ 55	3,7
≥ 50	4,0
< 50	5,0

2.1.3 Digital examination

The final exam will be conducted online on ISIS as an individual task. It will consist both of multiple choice questions and freeform questions testing both straight-up reproduction of the course knowledge (for example "fill in the blanks") as well as application (for example "identify problems and recommend solutions for a given analysis"). There will be XX aids such as written notes allowed.

What aids are allowed?

2.2 Grading Scale

The final grade is calculated as follows:

1. The component percentages are rounded to full points. Example: Getting 84% in a 10-point component leads to 8 points for this component.
2. The points for each component are summed up.
3. The final grade is calculated according to table 2

Please note that if any part of the exam is failed due to scientific fraud (e.g. plagiarism), the whole module will be graded as "failed" and will need to be repeated.

3 The Truly Cordless Drill

Your task for this semester will be to design a cordless drill. There is a twist though: It should work without utilitzing any electricity. By this we mean that it should still

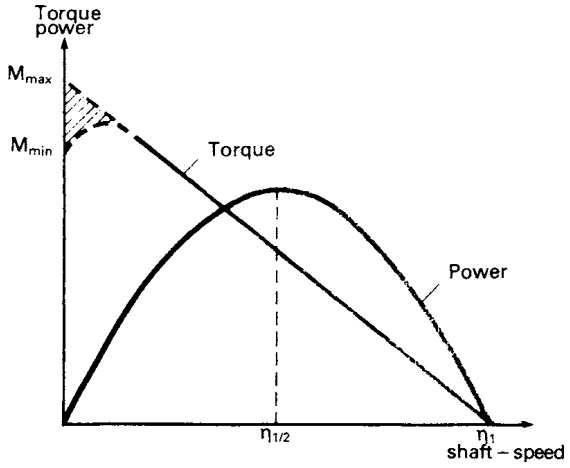

Figure 1: Exemplary speed-torque curve. Yours may differ! Source: [1]

work if all physical laws governing the flow of electricity in (semi)conductors were not to exist. Electrical motors, batteries and capacitors are out, as are electric switches and silicon-based control systems.

Specifically, what we are asking you to design is a

- Hand-holdable
- Rechargeable

device to produce

- A peak torque of 50 Nm
- A no-load rotational speed of 1500 $\frac{1}{min}$
- With the ability to do useful work at intermediate speeds and torques
- As selected by the user's graduated power demand
- For 5 minutes of continuous operation at the maximum power point without recharging
- applied to an industry-standard $\frac{1}{4}$-inch hexagonal socket according to DIN ISO 1173 form D. [2].

You are allowed to use a two-speed geared design. This device must operate and recharge without using any electricity, but it could be manufactured by processes that require electricity (so you don't need to design a mechanical lathe as well).

3.1 Tasks for the Project Report

The project report shall be a report on the development of your solution to the semester task. It should be a well-written technical/scientific report that contains the subtasks shown below. We expect these subtasks to be linked together in a reasonable structure, as well as an introduction describing the problem and a conclusion. It should observe the rules of good scientific and engineering practice as well as the stylistic "rules" of good typography. It should not exceed XX content pages[2] for the 1st submission and XX for the 2nd submission. The 1st submission should be submitted as a PDF file, 2nd submission should be submitted as a `.zip` archive containing the PDF report and the additional files.

Fill in pages for first submission

Fill in pages for the second submission

The 1st submission consists of the following subtasks:

- One SWOT analysis for the team skills and one for the product idea developed in the first workshop.
- A list of rquirements according to Pahl/Beitz [**Pahl2007**], using the template given on ISIS.
- A functional structure with sub-functions and the derivation of working principles for these subfunctions.
- A morphological box showing all possible sub-solutions.
- The systematic derivation of at least three possible solution variants using a reduced morphological box.[3]
- Coherent explanation and sketches of these three solutions
- Applying a weighing and value scales to the evaluation criteria shown in section 3.2.

The 2nd submission consists of the following subtasks:

- All content of the first submission, with revisions as per our corrections.
- A selection of a final concept using performance calculations and coherent assumptions.
- A detailed design of the final concept:

[2] "Content pages" refers to the page count excluding front and back matter, such as table of contents, bibliography etc.

[3] Completing this task requires the application of selection and evaluation methods. This has been missed by some groups in the past.

- A short functional description of the final concept with detailed pictures/drawings of the main functions.
- A claculation of the primary performance characteristics, describing the relevant mathematical formulas and showing the calculation of torque, no-load speed, power and energy.
- A risk assessment (FMEA).
- A parts list specifying the sourcing and cost of each part.
- A 3D CAD model in the STEP format.
- A plot showing the main dimensions of the final product.
- Manufacturing drawings (PDF) for the "classical" custom-made parts and STL files for the custom-made parts utilizing additive manufacturing.

3.2 Evaluation Criteria

References

[1] Antony Barber. "SECTION 5 - Applications". In: *Pneumatic Handbook*. Ed. by Antony Barber. Eighth Edition. Oxford: Butterworth-Heinemann, 1997, pp. 297–420. ISBN: 978-1-85617-249-3. DOI: https://doi.org/10.1016/B978-185617249-3/50006-4.

[2] *Schraubwerkzeuge – Mitnahme-Verbindungen für hand- und maschinenbetätigte Schraubendrehereinsätze und Verbindungsteile – Maße und Drehmomentprüfung.* DIN ISO 1173:2009-06. DIN e.V., June 2009.