SDM283 Mechanics for Design

Bitesize Project 2 — 3D Printer worktable

presented to you by

SDM283 teaching staff

2022 年 3 月 10 日

Report Instructions

In this project, your team will design a worktable that can accommodate at least eight Raise3D E2 3D printers (machine size: $607 \times 596 \times 465$ mm; weight: 35 kg). Your design should follow the following steps:

☐ Task 1. (20 points) Specification: from a strength-of-materials perspective of the design problem, propose the following design specifications: strength (5 points) , deflection (5 points) , weight (5 points) , and dimension (5 points) . Your design specifications should be justified first by preliminary calculations, and later adjusted according to further analysis (see Task 5).

☐ Task 2. (20 points) Structural design: design the structure and components (5 points) (e.g., beams, plates, shafts, trusses, columns), component sections (5 points) (e.g., circular, rectangular, I-section, T-section, tube), material selection (5 points) (using e.g., the concept of material index), and component connections (5 points) (e.g., cable, pin, tenon, bearing, fixed) of the worktable.

☐ Task 3. (20 points) Load & stress analysis: perform load analysis (5 points), stress analysis (5 points), deflection analysis (5 points), and stress concentration analysis (5 points) of the worktable design.

☐ Task 4. (20 points) Failure analysis: Based on the ductility and brittleness of the materials, choose appropriate failure criteria (e.g., von Mises stress, Coulomb-Mohr) to validate your design against static failure (10 points); validate your design against other types of failure (e.g., connection failure, buckling) (10 points). You are suggested to use both appropriate simulation software (e.g., MSC Adams, SolidWorks simulation, if necessary) and analytical methods (with the help of MATLAB) to validate your design.

☐ Task 5. (20 points) Iteration: based on Task 1 - 4, perform at least one iteration on your worktable design in terms of specification (5 points), structural design (5 points), load & stress analysis (5 points), and failure analysis (5 points).

表 1: Point allocations

task 1	Strength	Deflection	Weight	Dimension
	5	5	5	5
task 2	Structure	Section	Material	Connection
	5	5	5	5
task 3	Load	Stress	Detection	Stress concen.
	5	5	5	5
task 4	Static failure		Buckling, etc.	
	10		10	
task 5	Spec. iter.	Design iter.	Stress iter.	Failure iter.
	5	5	5	5

表 2: Work distributions

member	task 1 (%)	task 2 (%)	task 3 (%)	task 4 (%)	task 5 (%)

Video Instructions

Aside from your project report, MATLAB program and simulation, you will be required to produce and submit a three to five-minute video on your learning outcomes. The video must include but is not restricted to the following contents:

☐   A cover with proper title and abstract.

☐   A brief introduction to your team and project (objective, planning, execution, time management, etc.); each member is required to declare in person his/her tasks in the project.

☐   What have you learned from lectures of the second module (strength)?

☐   How did you apply your newly acquired knowledge to the accomplishment of bitesize project two?

☐   What difficulties have you met and how did you overcome them?

☐   What have you learned outside the classroom?

☐   A summary to wrap up your video.