Reachy Fusion Design Manual for [Head/Neck/Trunk/Arm/Gripper]

Design Engineer 1: Full Name, SUSTech Email, Mobile

Design Engineer 2: Full Name, SUSTech Email, Mobile

Design Engineer 3: Full Name, SUSTech Email, Mobile

Design Engineer 4: Full Name, SUSTech Email, Mobile

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Course Info: ME303 Introduction to Mechanical Design with Dr. Song Chaoyang

# (70%) Mechanism and Structural Design

## (10%) Design and Feasibility Analysis

### Abstract

An abstract that concludes with a short summary of the recommended design.

In the introductory part, use one sentence or two to provide the basic context of the design problem, comprehensible to an engineer in any discipline, explaining what your part of the design is all about, as specific as possible.

Next, use two or three sentences to elaborate further on the more detailed background of the design, comprehensible to engineer in a specific area with necessary but brief technical details.

Then followed by one sentence clearly stating the problem that is being addressed by this particular design, describing the gap that this design aims to address.

Start with words such as “Here we show” (or equivalent) to summarize the main result of this design in one sentence, stating the claim you wish to express with this design report.

Explain what you’ve done by explaining the main results in two or three sentences to support your claims or findings in this report. You can add another one or two sentences to put your results or analysis of the design into a more general context.

Finally, close your abstract with recommendations or implications in two or three sentences to provide a broader perspective based on your design analysis, answering either “what could be the next step” or “what would you do if you were to design it again?”

### Introduction

An introduction presents the context of the situation and then gives a clear and concise statement of the problem to solve.

The introduction should give enough background to the reader to understand the design challenge, the problem to solve, or the importance of the proposed solution. However, be mindful of only including key information and resist the temptation of doing a fully comprehensive literature review or elaboration.

You can start by introducing the topic generally, then orient readers in the field and show the need for the design, followed by the objective of the design.

You can also include a brief review of related designs that solve the same problem, with comments on the pros and cons of these designs from various perspectives to see how they may or may not solve the problem to what extent.

### Design Criteria

A list of design criteria, in order of importance, with the most critical first. Clear and concise design criteria are crucial to any design process. They establish the standards by which it is possible to determine whether a specific design is successful and to decide intelligently among competing designs.

Design criteria are the explicit goals a project must achieve to succeed. The design and decision criteria determine the document’s final recommendation for action. Managers use these criteria as their basic tool in evaluating a project’s potential for success and how well it fits into the goals of the organization. Experts need explicit design and decision criteria in order to evaluate recommended designs of devices and test procedures.

Design criteria can be divided into primary and secondary criteria. Primary criteria are those that constitute a successful project; the project will be unsuccessful if it does not meet these goals. Secondary criteria are those features that are highly desirable but not absolutely essential. Separating primary and secondary criteria establishes a clear hierarchy in design choices. Often, implementing one criterion makes the implementation of another infeasible or costly, or a secondary criterion may be sacrificed in favor of a primary criterion.

Make your design criteria short but as specific as possible. Avoid vague language. List your primary criteria first; then list the secondary criteria. Often design criteria are best displayed in bulleted lists, with short titles preceding the explanation. These titles may then be used later in the document to refer to the specific criteria being discussed. If you number your criteria, avoid referring to them later solely by number, a practice that often confuses readers. Use tables to show and summarize the relative effectiveness of different implementations in comparison with your design criteria.

### (Possible) Implementations

Describe the implementation of the Reachy part for your team.

Wisely use the Technical Drawings, Step-by-step Assembly, and Spec Analysis to formulate a coherent explanation of the implementation of the Reachy design.

### Design Recommendations

A recommendation with a comparison of alternatives.

If a design report does not present any alternative designs, it should still explain the reasons for specific design choices concerning the design criteria. Feasibility reports usually present one (or sometimes two) recommendations and argue for the recommended solution by showing how it best meets the stated criteria.

Graphic devices, such as a table listing how each implementation meets each design criterion, effectively summarize the reasons for the specific design recommendation.

### Final Remarks

Conclusion with recommendations for further actions and a listing of issues that must be resolved before the design can be implemented.

Limitations on what part of the problem this design cannot solve or how this report is limited in its analysis or results.

Future Work on what could be done in the future to improve the existing design.

## (20%) Mechanism Design

## (30%) Structural Design / Assembly Analysis

## (10%) Design Features

# (30%) CAD Usage and Expression

## (4%) List of Files and Completeness

A Zip file containing all files that can open on a local computer with a Readme of instructions, and another copy saved in the Fusion 360 Cloud folder.

## (4%) File & Design Reusability

The files are all linked with the assembly state clearly defined.

## (5%) Design Expression in Animation

An introductory animation of the whole assembly with basic movement, if any.

## (3%) Motion Simulation Analysis

Motion simulation plots based on motor selection and design parameters to narrow down the specs, with plots matching the results.

## (3%) Finite Element Analysis

Select at least one critical component for static stress analysis with the interpretation of the results.

## (5%) Optimization and Generative Design

Provide recommendations for design optimization or use generative design to improve at least 1 part.

## (2%) Selection of Material

Briefly summarize the selection of materials for each component of the Part of the Reachy that you are analyzing.

## (4%) Design Aesthetic

Provide a basic rendering of your Reachy design using Fusion 360 from various angles and details.

# (Optional) Any Thoughts on Reachy @ SUSTech

Can you think of a scenario where a robot like Reachy plays a role at SUSTech. Describe it here to elaborate your idea. Optional.