

What is the process of Functional Decomposition?



Functional decomposition is a term that engineers use to describe a set of steps in which they break down the overall function of a device, system, or process into its smaller parts. This is usually accomplished through thoughtful analysis and team discussions of project information and the result is a chart that describes the problem and or solutions in increasing detail.

Vocabulary- As a beginning engineer, there may be terms that may not be familiar. Here are some terms and their definitions that apply to the functional decomposition process.

A **function** is simply a task that is performed by a device, system, or process.

Decomposition is a process of breaking down. In this lesson, we will be breaking down functions into their smaller parts.

A **general function** is a function that requires other functions to work in order to take place. A general function may also be a sub function, since it may both *depend on* and *be depended on* by other functions.

A **subfunction** is a function that has to work in order for a more **general** function to take place. Remember, a subfunction may also be a general function.

A **basic function** is a function that has no smaller subfunctions.

Functional decomposition is a term that engineers use to describe a set of steps in which they break down the overall function of a device, system, or process into its smaller parts.

A **functional decomposition diagram** is a picture that engineers draw to help them understand how all of the general tasks and subtasks in a design fit together. They use tree diagrams because these are good for showing how big things can split into smaller things (just like the branches of a tree, which split into smaller twigs).

Steps to follow for the Functional Decomposition

1. Find the most general function

What is the most general task that your design needs to accomplish? Your group should come up with a one-sentence answer to this question and write it down. If you find that you need more than one sentence to describe this task, it is likely that you are incorporating some smaller functions into your answer. Try to identify the **function** that reflects the overall purpose of the design.

Begin a **functional decomposition diagram** by centering a short description of this most general function at the top of a piece of paper. Remember, all you need to write is *what* the function does, not *how* it does it.

2. Find the closest sub functions

What are the functions that must take place *immediately* before the most general function? You can place these (remember: tell us *what*, not *how*) on your **functional decomposition diagram**, connecting them with lines to your description of your most general function. Make sure that you are not choosing functions that require another step before the most general function can be completed – we'll use these in the next step.

3. Find the next level(s) of sub functions

For each of the functions that you put on your chart in step 2, find *their* closest sub functions and draw them on the **functional decomposition diagram**. Keep doing this until the functions on your diagram are **basic functions** that can't be broken down any further.

4. Check your diagram

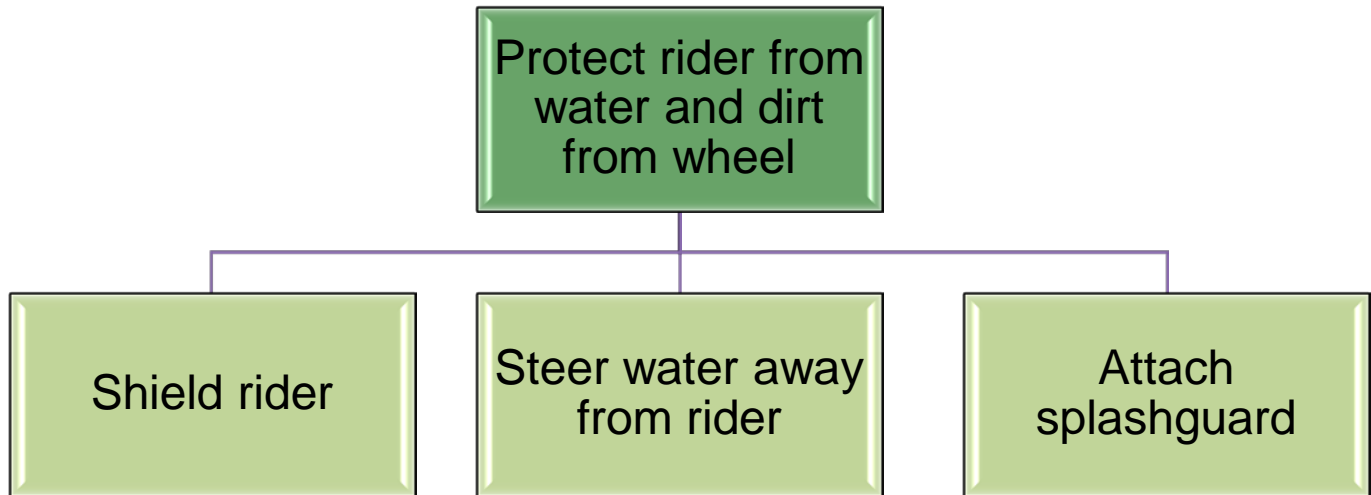
When you have completed your diagram, check to make sure that there are no additional functions that you have not included. If you think of one, try to figure out where it fits on the diagram and draw lines to show its place.

Functional Decomposition Example: A Bike Fender

The most **general function** of the bike fender is to protect the rider from water and dirt that fly off the wheel, but we can see here that there are **subfunctions** that make this happen. Protecting the rider requires three things from the fender: shielding them from debris, directing water away from them, *and* serving as the place where the splashguard attaches.



In the box for each function we can see that there is at least one action word (a verb) and one object that the action is directed toward (an object, which is always a noun). Sometimes there are words that tell us where materials are moving (for example, the fender steers “water away”), but other than this, the boxes do not have to contain much information. When you are drawing your own functional decomposition diagrams, the important thing is to write *what* a function does, not *how* it does it.



A lot of thinking goes into completing a functional decomposition diagram, but the job becomes easier if we think of it in terms of its individual steps.

Resources:

- Functional Decomposition: An Introduction for High School Engineers, EPICS Program 2009.