# Topic1

## Successful Design 成功的設計

This chapter gives you an introduction to designing enclosures for electronic products and defines a “successful design.”

本章為您介紹了電子產品外殼的設計，並定義了“成功的設計”。

### Electronic Product Enclosure (EPE = Electronic Product Enclosure)

### 電子產品外殼（EPE =電子產品外殼）

The electronic product enclosure consists of both the external and internal structural elements of a product.

電子產品外殼由產品的外部和內部結構元素組成。

One of the designer’s first tasks will be to define the “system” that they are designing.

設計師的首要任務之一是定義他們正在設計的“系統”

### The EPE Designer

### EPE 設計師

A good EPE Designer will have the following characteristics:

• Ability to understand and conform to the product specification

• Be able to add to and help create the product specification

• Create inventive solutions to the problems presented by the product

Thus, the EPE Designer must be able to both be creative and still follow the major objectives of the project.

一個好的 EPE 設計人員將具有以下特徵：

・理解並符合產品規格的能力

・能夠添加並幫助創建產品規格

・創建針對產品所存在問題的創造性解決方案

因此，EPE 設計人員必須既有創造力又能遵循項目的主要目標。

## Building the Design 建立設計

• Brand new design: This is a “clean sheet” start for the designer; they would basically have no constraints, other than complying with the specification. We’ll have an entire section on what exactly a specification is and its various components.

• Continuation (or adding to) an existing design: This is a variation on the brand new design, but only a small part of an existing design is to be modified. The designer here has many of the same challenges of the brand new design, but the additional work must utilize the existing design. We will have a separate section on defining

what exactly the “system” is in this context.

• Major modification of an existing design: Again, this is a variation on the brand new design, but in this case a large part of the original design is to be modified. The designer here is tasked with changing a part of the overall design, so there will be more constraints than a brand new design.

So, it’s important to know where the present design effort will fit into what has been previously done. Our “basic layout” can proceed either with or without the constraints of previous work.

・全新的設計：這是設計師的“整潔”開始；除了遵守規範外，它們基本上沒有任何限制。我們將在整個章節中介紹確切的規格及其各個組成部分。

・延續（或增加）現有設計：這是對全新設計的變體，但是現有設計中只有一小部分需要修改。這裡的設計師面臨著與全新設計相同的挑戰，但是額外的工作必須利用現有的設計。我們將在單獨的章節中定義在此上下文中“系統”的確切含義。

・現有設計的重大修改：同樣，這是對全新設計的修改，但在這種情況下，原始設計的很大一部分都將被修改。設計人員的任務是更改整體設計的一部分，因此與全新設計相比，存在更多約束。

因此，重要的是要知道當前的設計工作將適合先前所做的工作。我們的“基本佈局”可以在有或沒有先前工作約束的情況下進行。

## Structural Considerations 結構上的考慮

This chapter will focus on:

• Using strength of material concepts to propose structural solutions

• Defining a generic process for considering the structural design of our electronic enclosure

• Look at some examples that specifically illustrate the general concepts We'll close this chapter with a section titled "Bonus Section". This last section is meant to add some complications to our problems on strength of materials and also to show how other considerations besides strength will be important to our design choices.

本章將著重於：

・利用材料概念的優勢提出結構解決方案

・定義用於考慮電子外殼結構設計的通用過程

・查看一些具體說明一般概念的示例我們將在本章中最後一節標題為“獎金部分”。最後一部分旨在給我們在材料強度方面的問題增加一些複雜性，並展示除強度以外的其他考慮因素對於我們的設計選擇如何重要。

## Materials and Processes 材料和加工

Coupled with cost is the aspect of time. This leads to certain scenarios that are likely

to play out in the life cycle of the product as:
1. Emphasis on time in material/process/manufacturability choice for the early stages of the development process
2. A “high-production” and cost-reduced product release can come occur in the later stages of the development process

成本是時間的一部分。這導致某些情況可能會在產品的生命週期中發揮作用，例如：

1.在開發過程的早期階段，在材料/過程/可製造性選擇上強調時間

2.在開發過程的後期可能會出現“高產量”和降低成本的產品發布

## The Designer’s Mind Space

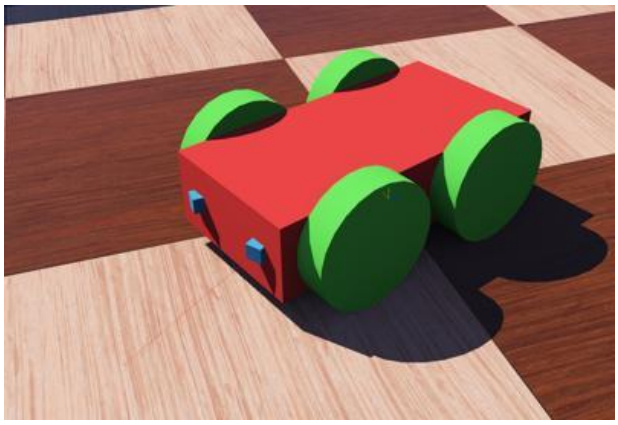
## 設計師的思維空間

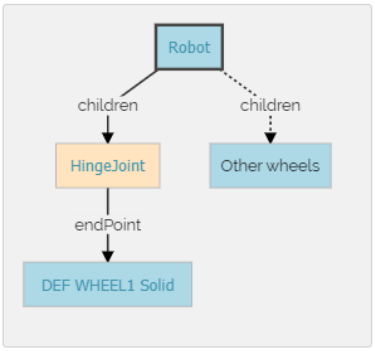
The designer has to “think ahead.” When faced with designing an electronic enclosure, here are some things that go on in the mind of a designer, hopefully, all at the same time (Cost (Chpt4)).
設計師必須“先思考”。在設計電子外殼時，希望設計師可以同時想到以下幾件事（成本（第四章））。
• How big?
• How many parts are needed to accomplish purpose?
• Has this (or a slight variation) been done before? Here, or at another company? How has the product purpose been accomplished by the competition?
• What is the “user interface,” that is, how will the customer use this product (buttons/displays/lights/doors/connections for power, input, and output)?
• I am designing this portion of the product, what are the other portions that I am not (directly) responsible for?
• How quickly can I present some ideas that will solve the problem? How quickly can I prototype these ideas to check out the feasibility of an idea? Who else can I brainstorm with to critique these ideas?
・多大？
・完成目標需要多少部分？
・是否曾經做過（或稍作改動）？在這裡，還是在另一家公司？競爭如何實現產品目的？
・什麼是“用戶界面”，即客戶將如何使用該產品（按鈕，顯示屏/燈/門/電源/輸入和輸出的連接）？
・我正在設計產品的這一部分，我不（直接）負責的其他部分是什麼？
・我多快提出一些解決問題的想法？我可以多快為這些創意製作原型以檢查創意的可行性？我還能集思廣益批評這些想法嗎？

# Webots 4-Wheels Robot

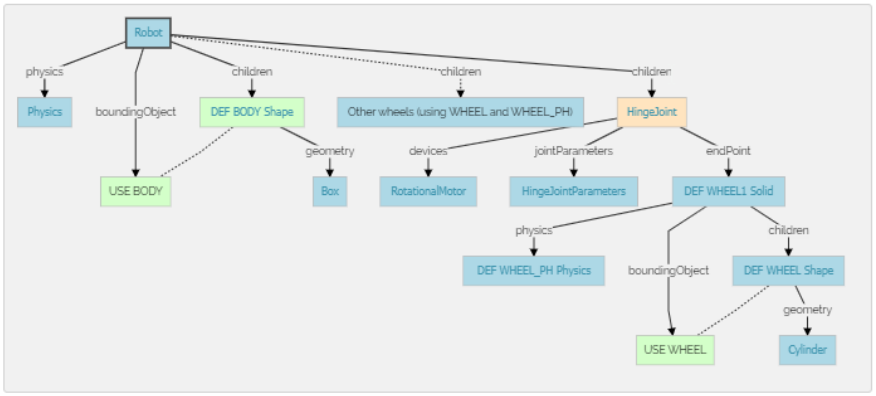
The aim of this tutorial is to create your first robot from scratch. This robot will be made of a body, four wheels, and two distance sensors. The result is depicted on this figure. The next figure shows the robot from a top view.

本教程的目的是從頭開始創建您的第一個機器人。該機器人將由一個身體，四個輪子和兩個距離傳感器組成。結果顯示在此圖上。下圖從俯視圖顯示了機器人。






*High level representation of the 4 wheels robot*

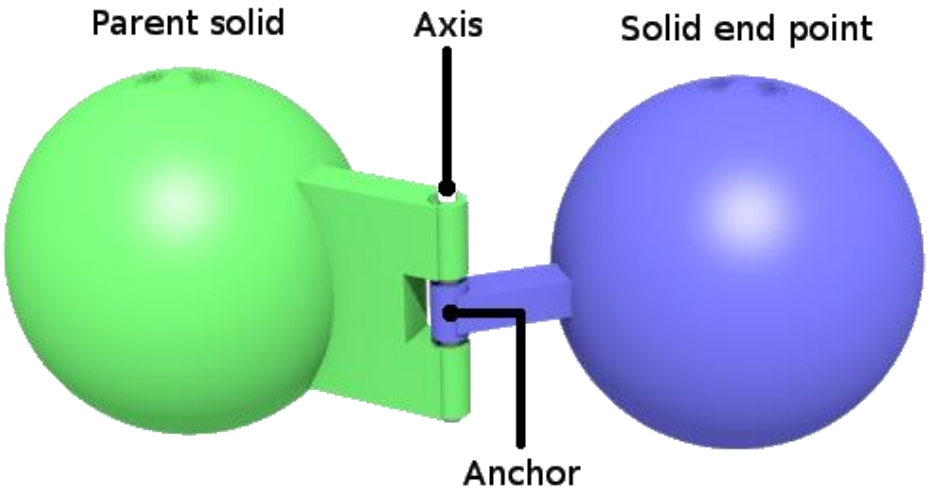



*Low level representation of the 4 wheels robot*

四輪機器人的高階與低階表示

The initial position of the Wheel is defined by the translation and the rotation fields of the Solid node. While the rotation origin (anchor) and the rotation axis (axis) are defined by the optional HingeJointParameters child of the HingeJoint node.

Wheel 的初始位置由實體節點的平移和旋轉字段定義。而旋轉原點（錨點）和旋轉軸（軸）由 HingeJoint 節點的可選 HingeJointParameters 子級定義。




## Sensors 感測器

DistanceSensor nodes as direct children of the Robot node. Note that the distance sensor acquires its data along the +*x*-axis. So rotating the distance sensors in order to point their *x*-axis outside the robot is necessary (see the figure).

機器人建模的最後一部分是將兩個距離傳感器添加到機器人。這可以通過添加兩個 DistanceSensor 節點作為 Robot 節點的直接子節點來完成。注意，距離傳感器沿+ *x* 軸獲取其數據。因此，旋轉距離傳感器以使其 *x* 軸指向機器人外部是必要的

最後加上 The Controller Code

**Data sources:** https://cyberbotics.com/doc/guide/tutorial-6-4-wheels-robot MechanicalDesignProcess.pdf.