快速原型(Rapid Prototyping)、快速製造(Rapid Manufacturing)

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報告日期 ： **94. 09. 12.**

何謂快速原型(RP)

原型技術製造的方法不外乎除去、增加、成型等三種方式。一般來說除去、成型為加工最常用的方式，而增加的方式除了銲接等少數方法外，幾乎無任何加工機具是使用材料增加的方式來進行，而目前所普遍使用的快速原型技術則是突破傳統之加工觀念，使用材料增加的層加工方式來進行，從2D的薄片一層一層的堆疊而成為3D的物體。

RP加工的製程

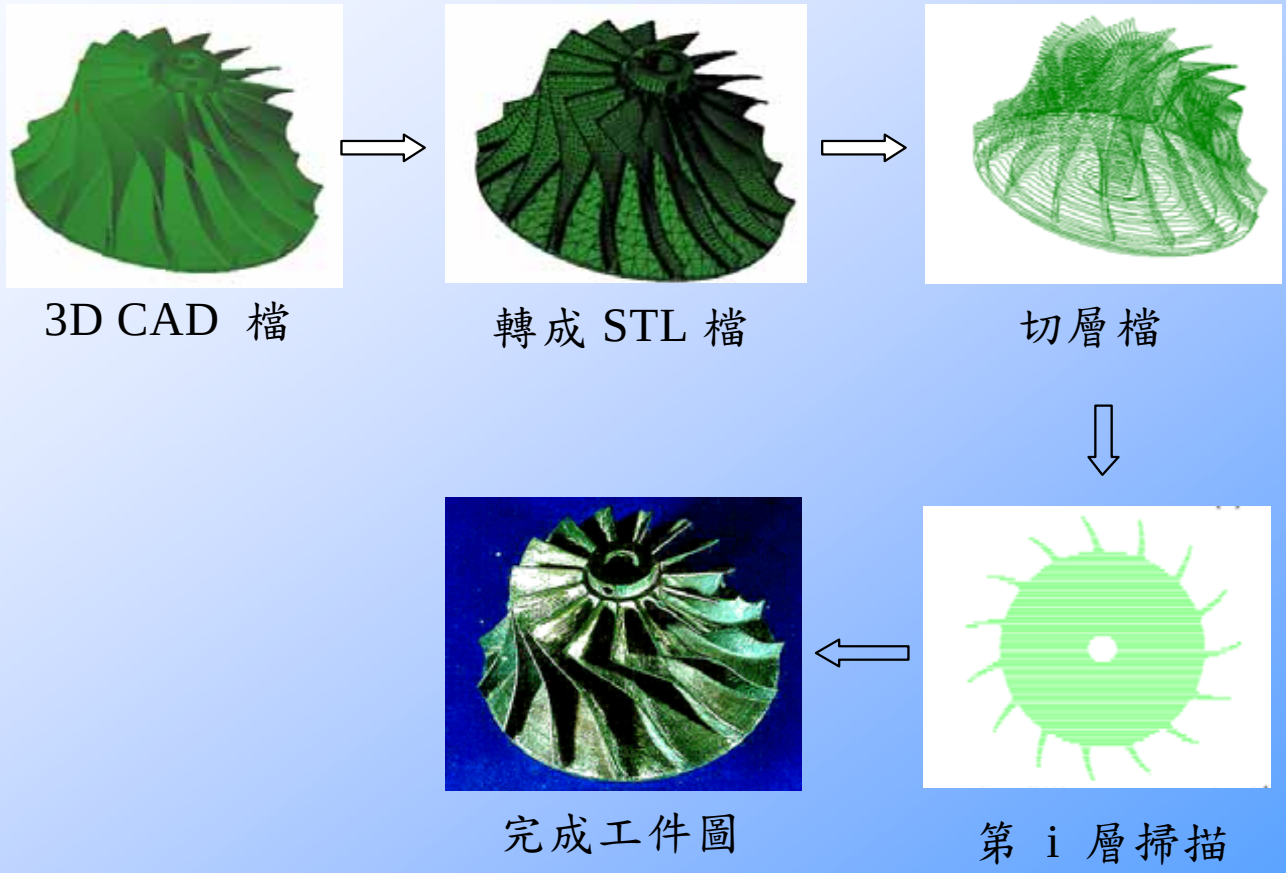


圖1 RP加工的製程

快速原型系統的製程

(一) CAD製程

(二) 介面轉換(將3D 實體模型圖檔轉換成STL檔)

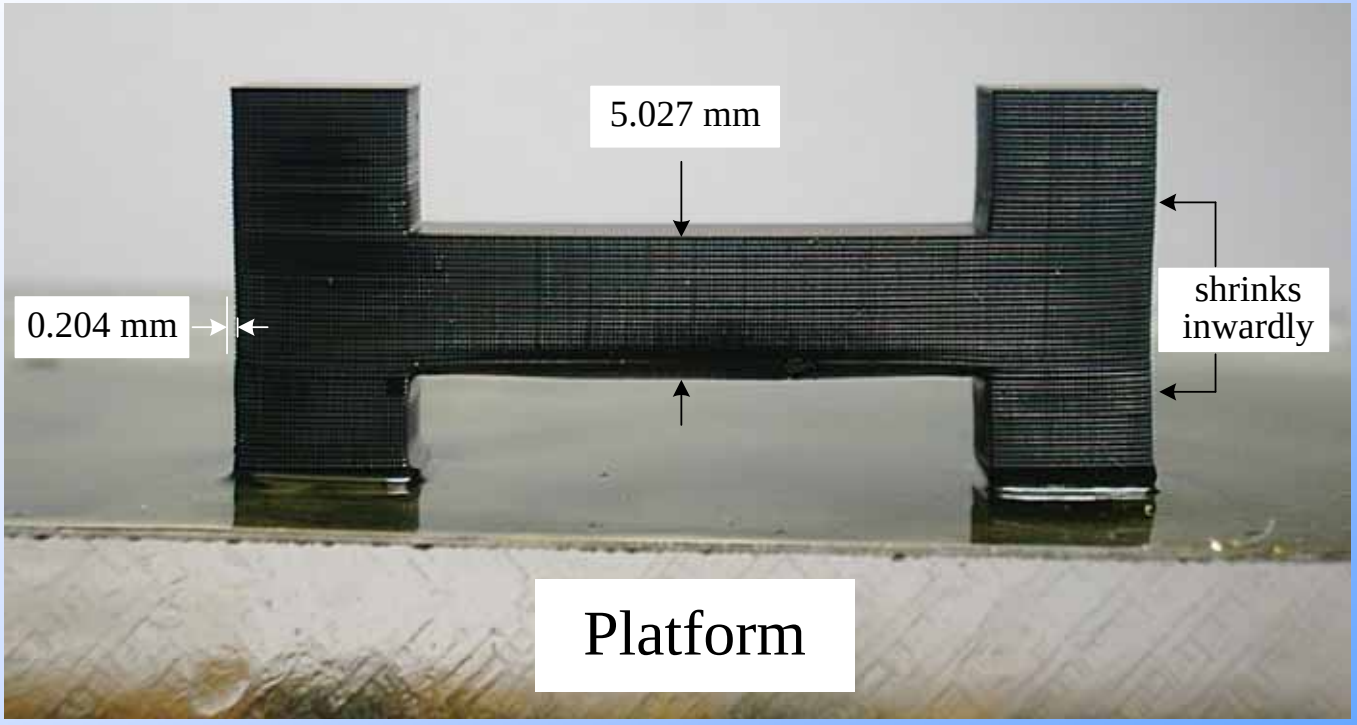
(三) 切層

(四) 雷射加工路徑規劃或光罩產生

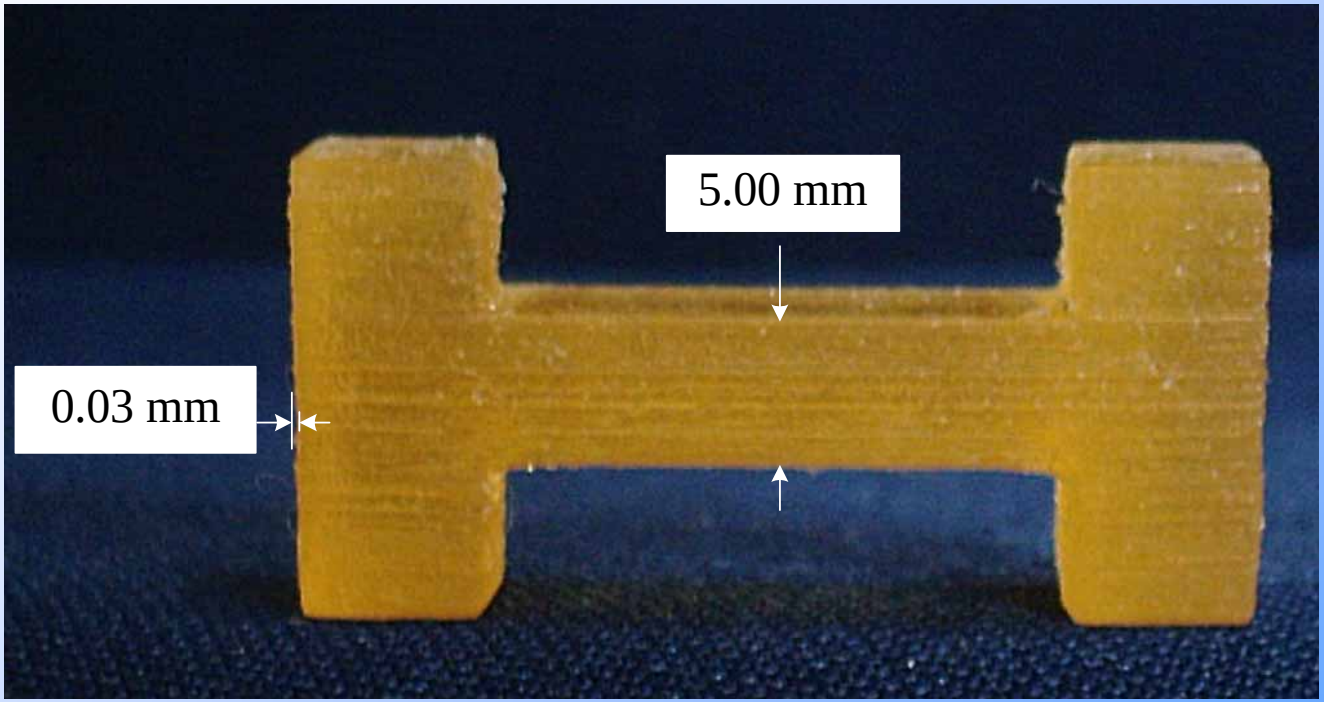
(五) 機台加工

(六) 後處理

液態類光造型加工範例



Objet-Quadra-Tempo RP
系統所建構之工件

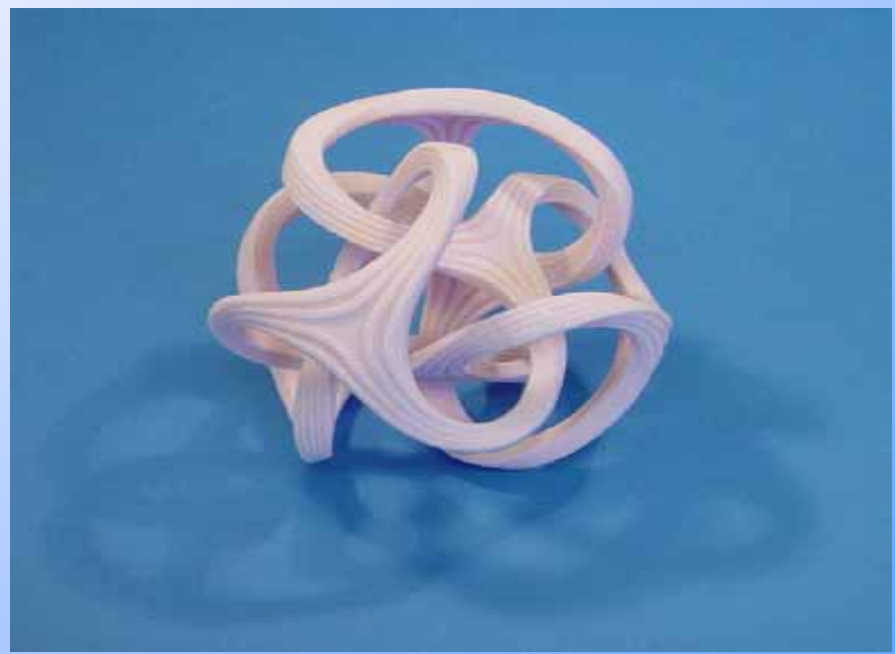


3D Printing Example Part (1)

- This 3DP™ model of the dome at MIT's Great Hall demonstrates the intricacy and detail possible with the process.

3D Printing Example Part (2)

- This object was printed directly from a mathematical model and would be extremely difficult to manufacture by conventional techniques. It is intended as an illustration of the geometric capability of 3D Printing. This model was made by Z Corp.



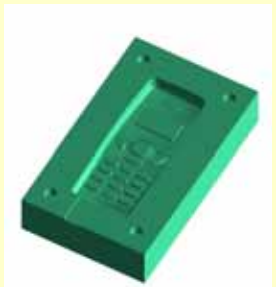
3D Printing Example Part (3)

- This photo shows a family of injection molding tools made by 3D Printing. The tool in the lower left corner is approximately 150 mm long. Many of these tools have conformal cooling channels printed within them. Such channels lead to far better temperature control during the injection molding resulting in faster production and high quality parts.

適應性原型製作方式

(一)快速成型機製作原型

- 材質：**photopolymer、ABS、nylon、wax、metal、rubber 、paper ……**
- 特性：沒有加工不出來的形狀、不必進行NC程式轉換、原型製作時間短(hours)、工作環境佳可作為辦公室設備、變形問題困擾、精度**0.025-0.3mm**
- 使用時機：造型複雜、加工不易、精度要求頗高


生醫工程應用(1)

Overview of Presentation

General view of RP

RP for medical purposes (Medical Modelling)

Different applications

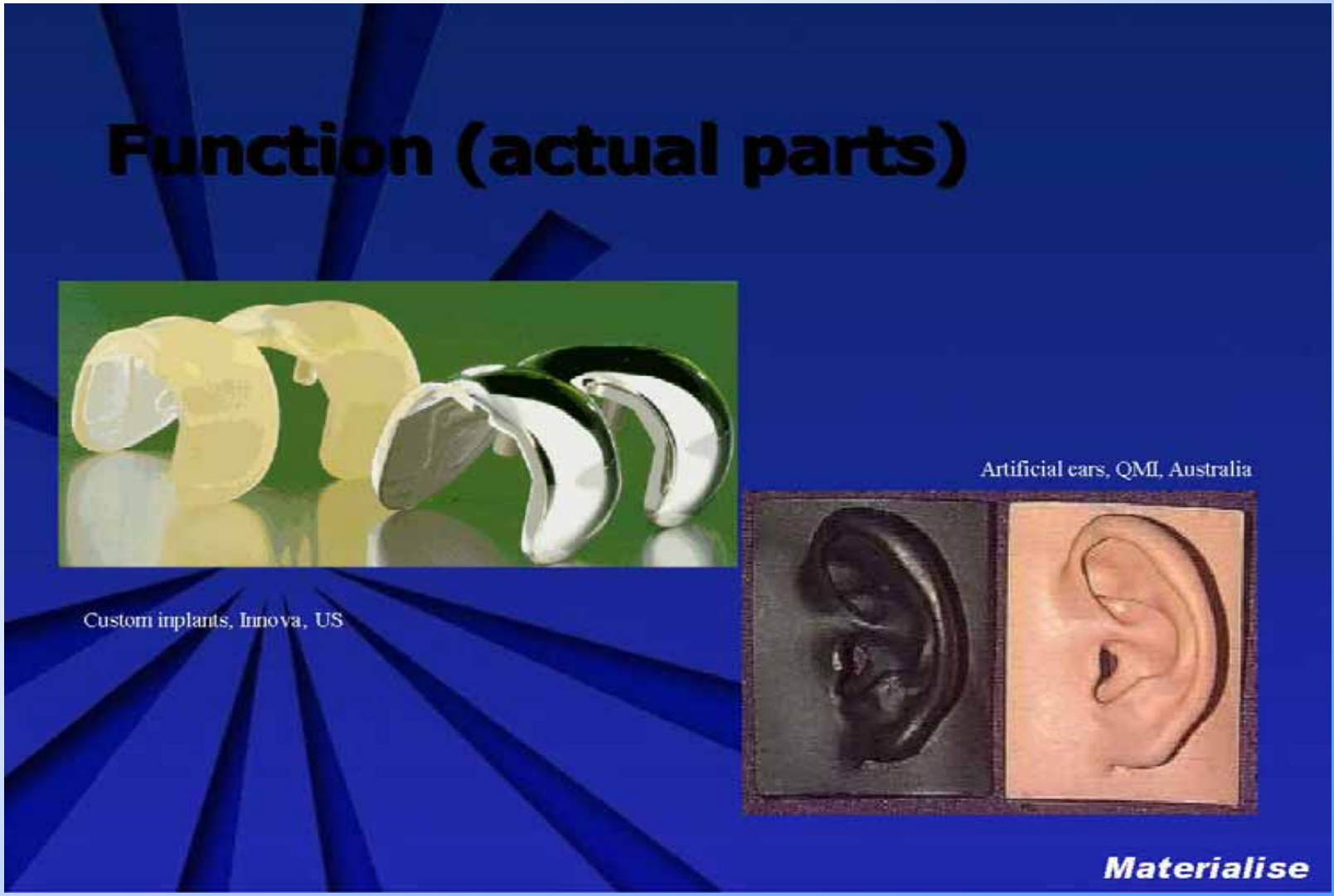
Hardware issues

Software issues

Source -http://www.rapidprototyping.net/

Materialise

生醫工程應用(2)


Function (actual parts)
Custom inplants, Innova, US
Artificial ears, QMI, Australia
Materialise

生醫工程應用(3)

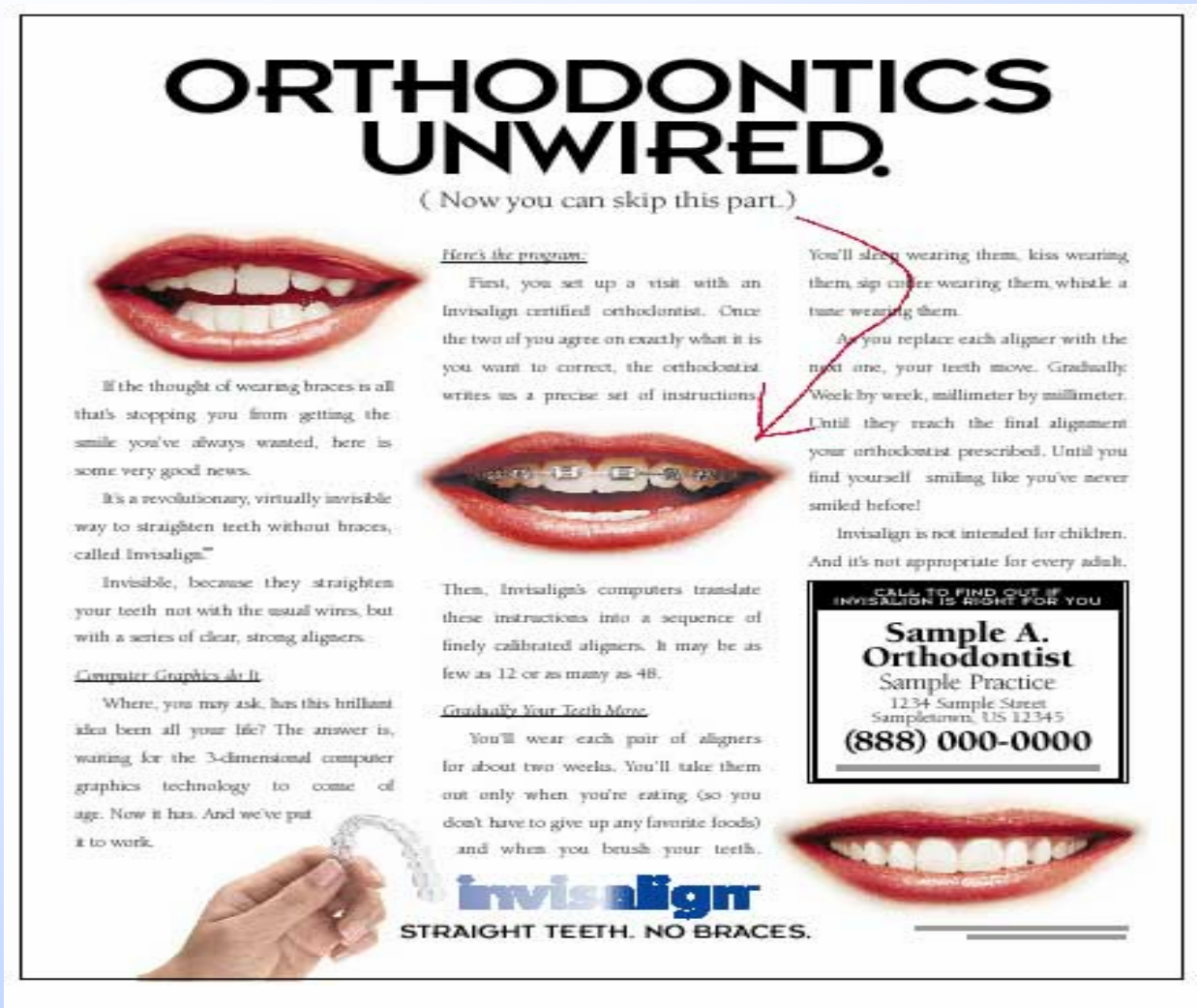
Immediate smile

- Today: Temporary Bridge
  - Simulate surgery with SurgiGuides on model
    - Stereolithographic model (bone supported)
    - Plaster Study model (tooth and mucosa supported)

  - Dental Laboratory creates a temporary bridge
    - Articulation, Occlusion
    - Holes slightly bigger than abutments to cover residual errors

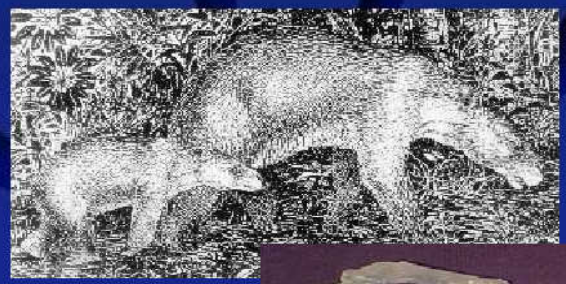
Materialise

生醫工程應用(4)


ORTHODONTICS UNWIRED.
(Now you can skip this part.)
If the thought of wearing braces is all that's stopping you from getting the smile you've always wanted, here is some very good news.
It's a revolutionary, virtually invisible way to straighten teeth without braces, called Invisalign.™
Invisible, because they straighten your teeth not with the usual wires, but with a series of clear, strong aligners.
Computer Graphics do it
Where, you may ask, has this brilliant idea been all your life? The answer is, waiting for the 3-dimensional computer graphics technology to come of age. Now it has. And we've put it to work.
Here's the program:
First, you set up a visit with an Invisalign certified orthodontist. Once the two of you agree on exactly what it is you want to correct, the orthodontist writes us a precise set of instructions.
Then, Invisalign's computers translate these instructions into a sequence of finely calibrated aligners. It may be as few as 12 or as many as 48.
Gradually Your Teeth Move
You'll wear each pair of aligners for about two weeks. You'll take them out only when you're eating (so you don't have to give up any favorite foods) and when you brush your teeth.
You'll sleep wearing them, kiss wearing them, sip coffee wearing them, whistle a tune wearing them.
As you replace each aligner with the next one, your teeth move. Gradually. Week by week, millimeter by millimeter. Until they reach the final alignment your orthodontist prescribed. Until you find yourself smiling like you've never smiled before!
Invisalign is not intended for children. And it's not appropriate for every adult.
CALL TO FIND OUT IF INVISALIGN IS RIGHT FOR YOU
Sample A. Orthodontist
Sample Practice
1234 Sample Street
Sampletown, US 12345
(888) 000-0000
invisalign
STRAIGHT TEETH. NO BRACES.

生醫工程應用(5)

Other related applications



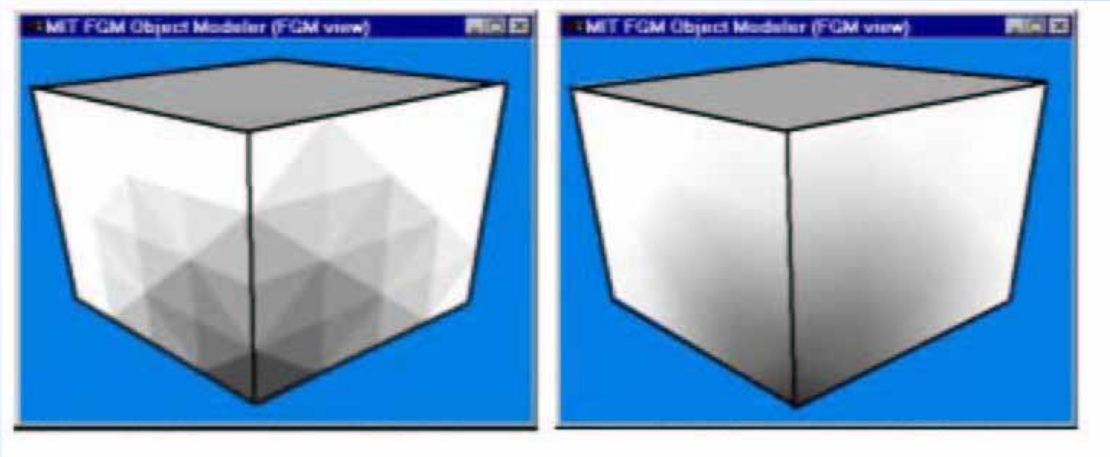
Paleontology(古生物學) - Juvenile Diprotodontid(雙門齒) Skull BioModel, QMI, Australia

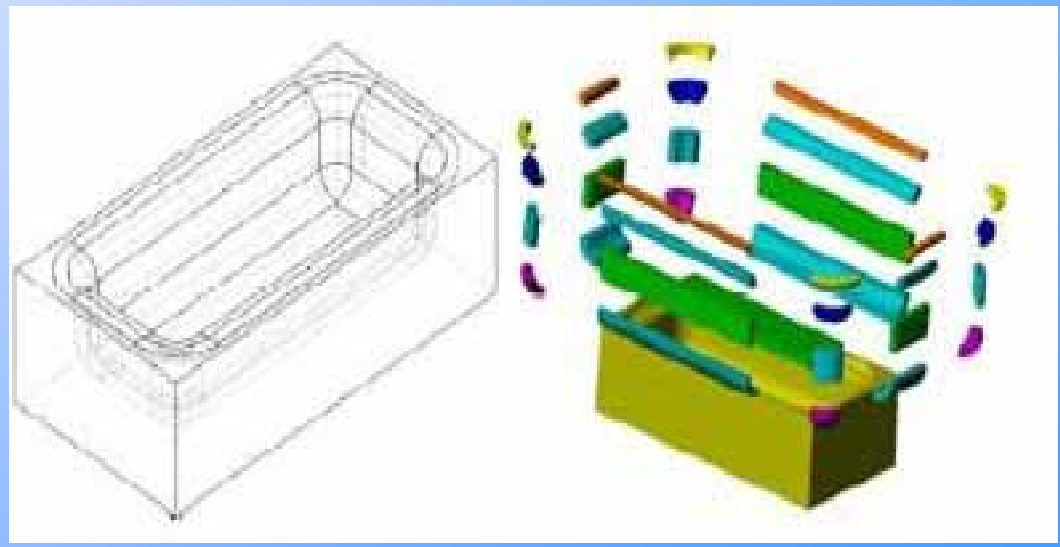
Informed consent, arteries(動脈) at the base of brain, QMI

Legal - personal injury, malpractice(誤診)- cracked skull, Innova, US

Materialise

功能性梯度材料(FEM)產品範例





快速原型的優點

由於快速原型加工方式為層加工的材料增加方式，故無切削力的產生，無須設計複雜的夾治具亦無撞刀及刀具磨耗等問題，無論再怎麼複雜的形狀，只要能從CAD 軟體畫出，即可由快速原型機自動地「成長」出原型。

研究過程

- 具有高度的興趣
- 要會撰寫高階程式語言
  (C語言或VB或 Fortran語言)
- 本研究要組裝一台RP機器(包含機電控制部分)
- 要會電腦繪圖(Pro/E或其他軟體)

報 告 完 畢

謝 謝 ！

歡迎具有研究熱忱的朋友

一起加入研究行列 ！！