Computer-Aided Design

- CAD software is an essential engineering tool
- 2D drawings and 3D objects with exact dimensions
- Plans and mapping
- 3D modelling views using newer rendering and visualisation algorithms
- Supports standard object representations to allow sharing of component designs
- May be programmable
- Goal is CAD/CAM (Computer Aided Manufacturing):
  - CAD design data used directly to drive a CNC machine tool to create a physical component

* Computer Numerical Control, a natural extension of 19th century weaving machines, player pianos

---

Most popular product: AutoCAD®

- First version released 1982 for early PCs
- Originally inputs were completely text command-based, still persists as an option
- File format DWG is an industry standard
- Since 2008 has adopted an Office ribbon style menu structure
- Users tend not to upgrade older versions, for example, support materials in Built Environment are for AutoCAD 2000
- Can edit while in 3D view mode
- Demos on Autodesk’s website (www.autocad.com) or:
  - [www.youtube.com/watch?v=rK58M_y43jY](https://www.youtube.com/watch?v=rK58M_y43jY)
- Not the only CAD product, others include Solidworks, MicroStation, progeCAD (AutoCAD clone), Alibre

---

AutoCAD® 2002 Sample

Note simple 3D rendering

---

AutoCAD® 2011 Sample

---

SOLIDWORKS 2010 Sample
Mathematical Modelling and Simulation

- Maple and MapleSim  
  - core computations in Maple
  - MapleSim built on top for dynamic modelling
  - example: Mechanical/Hydraulic model used to increase loading cap of scissor lift (see vendor’s site)

Mathematical Modelling, continued

- Mathematica  
  - symbolic package with visualisation language
  - more suitable for demos (layout code is cumbersome)
  - example: Cryogenic Recovery of Acetone from Air

Other specialised software

- Each engineering discipline represents a market for software to solve problems specific to that domain. Some examples follow

Mathematical Modelling, continued

MATLAB  


- more suited to pure mathematical models and calculations than engineering models

More specialist software

- Coldes – Concrete column design,  

3D Printing: Software Model to Solid Objects

- 3D printing (also known as additive manufacturing) creates a solid 3D object from a software model (i.e. an AutoCAD model to a solid 3D object).
- In 3D printing, an object is created by laying down successive layers of material (known as an additive processes).
- Easy to customise a software model, in order to create a customised product (3D object), like dental implants, height adjusted table, etc.
- On demand customised production! Is it the end of "mass production"?
  - "A third industrial revolution"  
    - The Economist (21/April/2012)

- Video presentation:  
  http://www.cse.unsw.edu.au/~en1811/12s1/3D-printing.html
Conclusion

• Engineers use both general-purpose and specialised software, according to need and availability
• Packages assist in the design process by improving
  – design times (productivity increase)
  – how well engineers understand the problem and the selected solution (through modelling)
  – reliability of the design due to inbuilt error checks
  – design-to-manufacture processes (especially with CAD/CAM)
• As with all design activities, whether planning or drafting or programming or anything else…

make sure the final product solves the problem you have in mind, not something else.