

3D PRINTER INDUCTION

ANTONIO PASSARO

FIRST ISSUE - SEP 2009

1. INTRODUCTION

THE 3D PRINTER IS A MACHINE THAT BUILDS 3D MODELS USING DATA FROM 3D-MODELLING SOFTWARE. WITH THIS REMARKABLE TECHNOLOGY, YOU CAN QUICKLY AND INEXPENSIVELY TRANSFORM YOUR DESIGN IDEAS INTO HAND-HELD, CONCRETE REALITY.

3D PRINTING IS VALUED IN COMMERCIAL SETTINGS FOR ITS ABILITY TO STREAMLINE THE DESIGN PROCESS. PROTOTYPE DESIGNS THAT ONCE HAD TO BE MILLED OR MOLDED BY HAND CAN NOW BE "PRINTED" IN A MATTER OF HOURS, AND AT A FRACTION OF THE COST OF OLDER METHODS.

OUR DIMENSION 3D PRINTERS BUILDS ACCURATE MODELS LAYER BY LAYER USING DURABLE ABS PLASTIC THAT CAN BE SANDED, MILLED, DRILLED AND PAINTED.

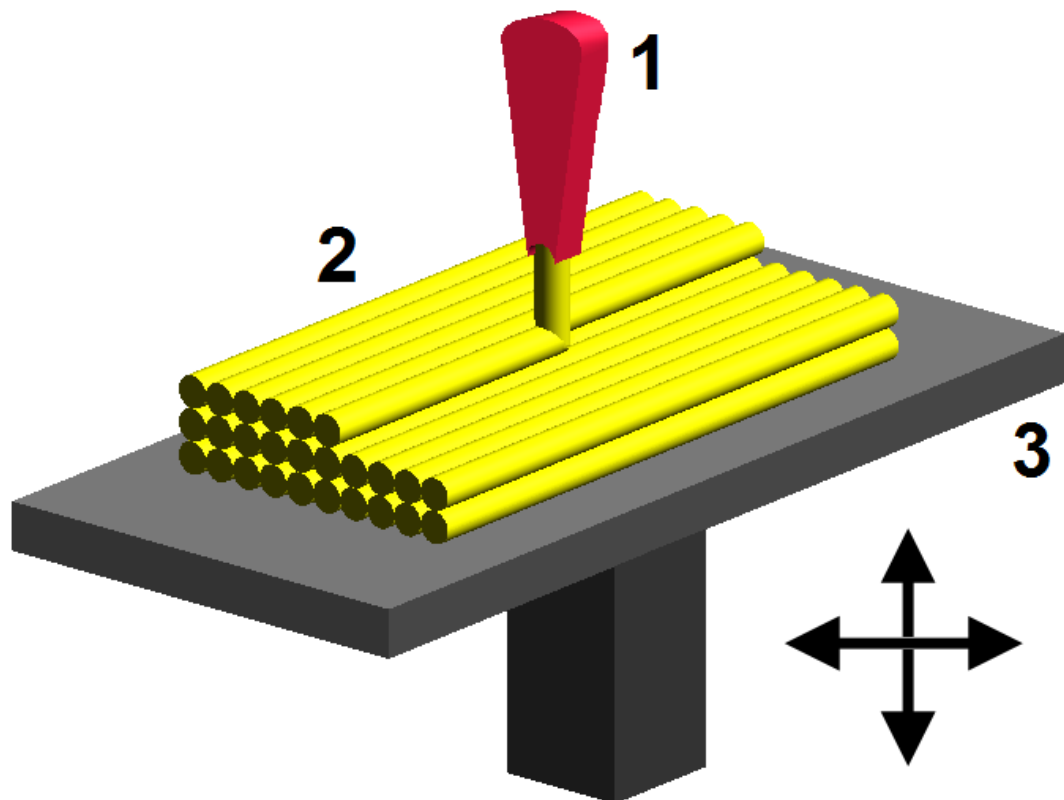


2. PROCESS

THE 3D PRINTER WORKS WITH 3D DATA FILES (STL (STEREOLITHOGRAPH) FORMAT). THESE FILES CAN BE CREATED WITH POPULAR COMMERCIAL PROGRAMS LIKE MICROSTATION, AUTOCAD, RHINO3D, SOLIDWORKS, OR 3D STUDIO MAX .

THIS INFORMATION IS THEN SENT TO THE MACHINE WHERE IT STARTS TO DEPOSIT MATERIAL LAYER BY LAYER, THUS CREATING A 3-DIMENSIONAL OBJECT, THIS PROCESS IS KNOWN AS FDM (FUSED DEPOSITION MODELLING)

LIKE MOST OTHER ADDITIVE MANUFACTURING PROCESSES FDM WORKS ON AN "ADDITIVE" PRINCIPLE BY LAYING DOWN MATERIAL IN LAYERS. A PLASTIC FILAMENT IS UNWOUND FROM A COIL AND SUPPLIES MATERIAL TO AN EXTRUSION NOZZLE WHICH CAN TURN ON AND OFF THE FLOW. THE NOZZLE IS HEATED TO MELT THE MATERIAL AND CAN BE MOVED IN BOTH HORIZONTAL AND VERTICAL DIRECTIONS BY A NUMERICALLY CONTROLLED MECHANISM, DIRECTLY CONTROLLED BY A COMPUTER-AIDED MANUFACTURING (CAM) SOFTWARE PACKAGE. THE MODEL OR PART IS PRODUCED BY EXTRUDING SMALL BEADS OF THERMOPLASTIC MATERIAL TO FORM LAYERS AS THE MATERIAL HARDENS IMMEDIATELY AFTER EXTRUSION FROM THE NOZZLE.



- 1 - NOZZLE EJECTING MOLTEN MATERIAL (PLASTIC)
- 2 - DEPOSITED MATERIAL (MODELLED PART)
- 3 - CONTROLLED MOVABLE TABLE

3. PREPARING THE MODEL

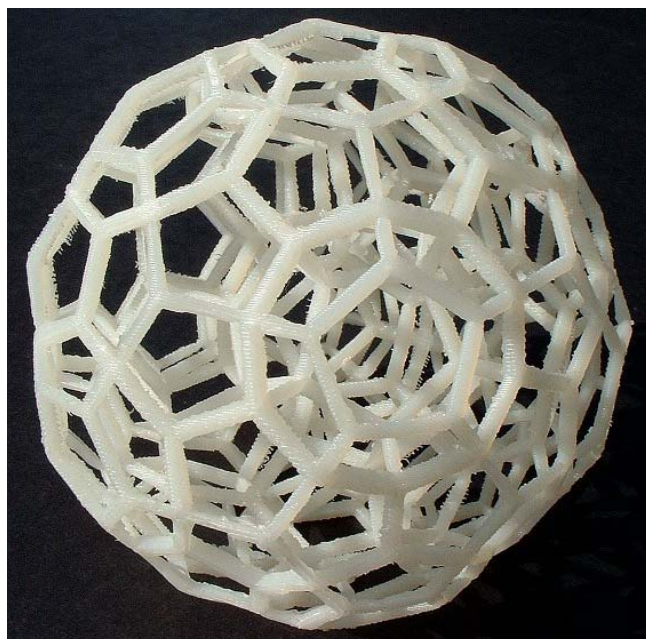
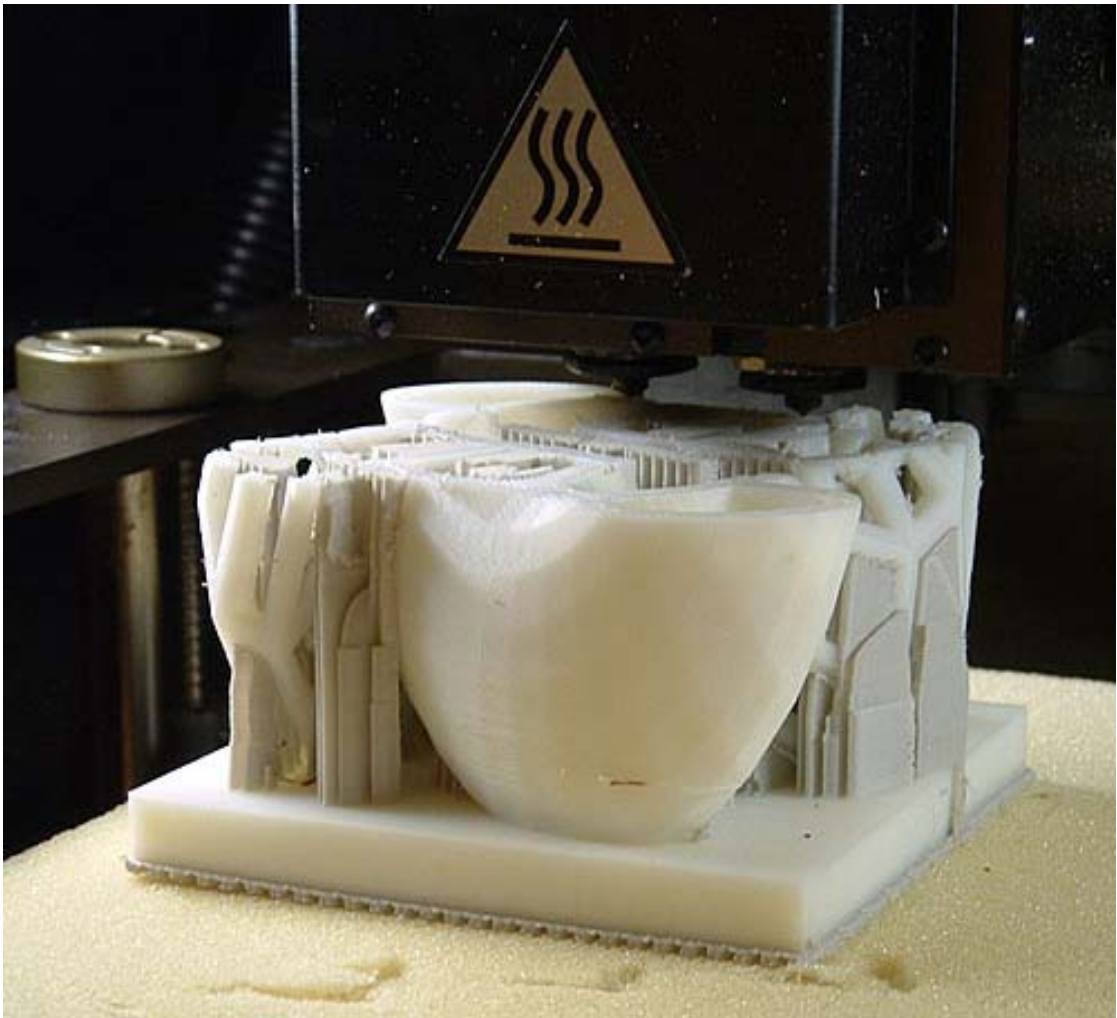
THE MACHINE ONLY ACCEPTS STEREO-LITHOGRAPHY (STL) FILES. HOWEVER, MOST 3D MODELLING APPLICATIONS, INCLUDING RHINO, 3D STUDIO AND MICROSTATION ARE CAPABLE OF EXPORTING FILES IN THIS FORMAT. WHEN EXPORTING AN STL FILE, YOU MAY NEED TO CHOOSE A STROKE TOLERANCE AND OTHER SIMILAR PARAMETERS. THESE SETTINGS WILL VARY DEPENDING ON THE MODELLING APPLICATION YOU ARE USING. SOME TRIAL AND ERROR MAY BE REQUIRED TO GET THE OPTIMUM CONFIGURATION.

ALSO, SINCE THE MACHINE IS EXPECTED TO MAKE A PHYSICAL MODEL IT IS IMPORTANT THAT YOUR MODEL HAS SUITABLE INTEGRITY – THAT MEANS THAT ANY SURFACE-TYPE ELEMENT MUST HAVE A MINIMUM THICKNESS OF ABOUT 1.5MM (AT THE TRUE MODEL SCALE) AND ANY STRUT-TYPE ELEMENT SHOULD BE AT LEAST 3MM IN CROSS-SECTION. A UTILITY CALLED THE CMB VIEWER HAS BEEN INSTALLED ON ALL THE MACHINES IN THE STUDIO AND THIS SHOULD ALLOW YOU TO OPEN AND VIEW THE STL FILES YOU HAVE CREATED. (WATCH OUT FOR SURFACES THAT APPEAR TRANSPARENT OR HAVE A CHEQUERED APPEARANCE – THIS INDICATES THAT THE SURFACE HAS NO THICKNESS OR THAT THE SURFACE NORMALS ARE REVERSED). A BETTER WAY OF CHECKING YOUR STL FILE, IS HOWEVER TO DOWNLOAD AND INSTALL A FREE PIECE OF SOFTWARE CALLED MINI-MAGICS. THIS IS AVAILABLE FROM MATERIALISE.COM. THE FULL VERSION OF MAGICS CAN FIX AND MODIFY STL FILES BUT IS VERY EXPENSIVE. MINI-MAGICS ALLOWS YOU TO CHECK AND TO MEASURE YOUR STL FILE. PLEASE MAKE SURE THAT YOUR MODEL IS FREE OF RED OR YELLOW HIGHLIGHTED ELEMENTS IN MINI-MAGICS BEFORE BRING IT TO BE BUILT. IF THE MODEL IS OK IT WILL BE ALMOST ENTIRELY GREY IN MINI-MAGICS.

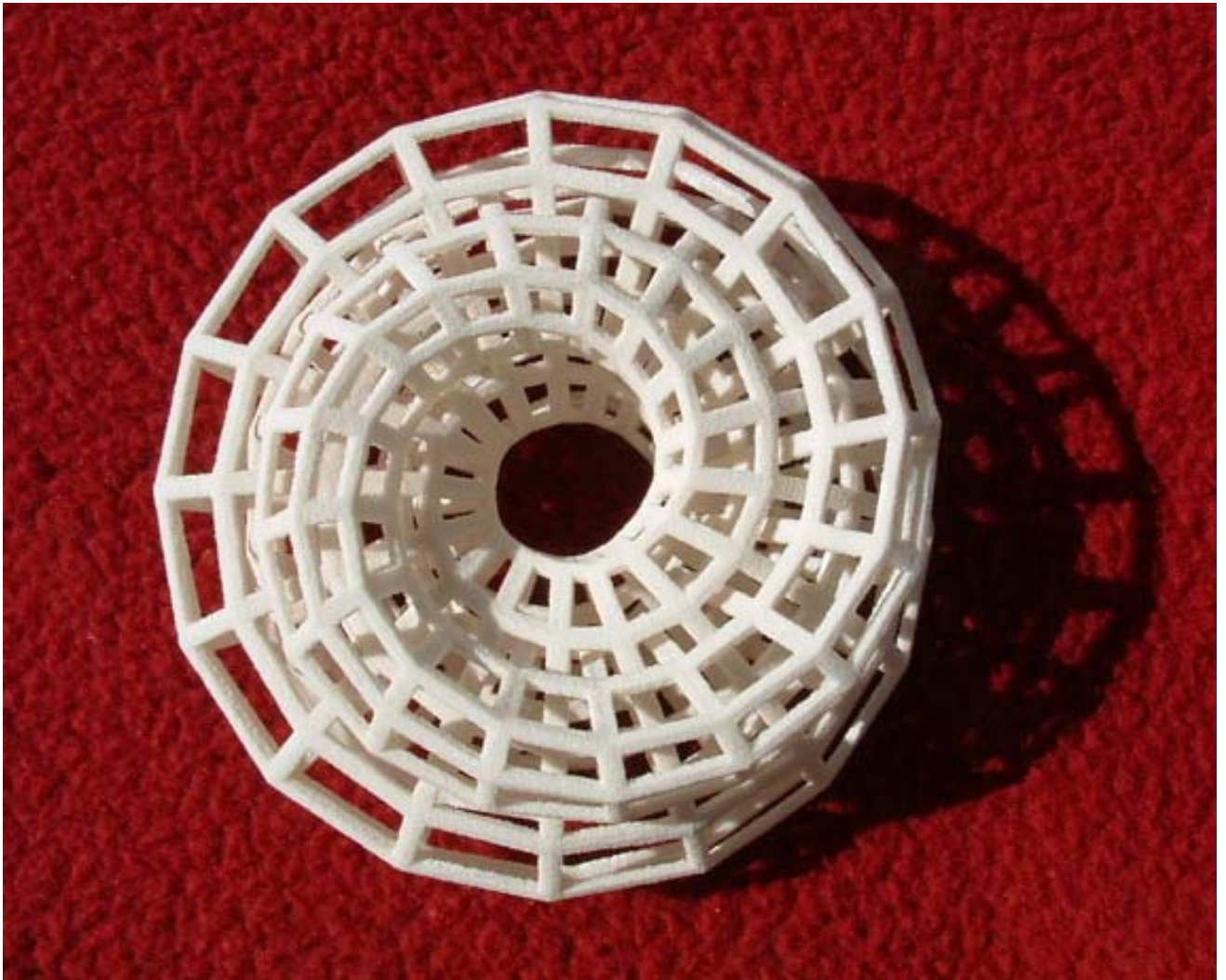
THE WORKING AREA FOR THE 3D PRINTER IS ABOUT 200MM X 200MM X 200MM BUT SIZABLE MODELS ARE LIKELY TO BE EXPENSIVE. YOU SHOULD ALSO CONSIDER THE FACT THAT SUPPORT STRUCTURE WILL BE GENERATED BY THE MACHINE TO HOLD THE MODEL IN PLACE AS IT BUILDS. YOU ARE ADVISED, WHERE NECESSARY, TO MAKE A SERIES OF MODEL COMPONENTS RATHER THAN ATTEMPTING TO MAKE A COMPLETE VOLUME.

FINALLY, WE DO HAVE SOME SCOPE FOR FIXING AND RESIZING AT THE POINT WHEN THE MODEL IS SENT TO THE MACHINE BUT IT IS BEST TO RESOLVE THESE ISSUES IN THE MODEL ITSELF.

4. EXAMPLES OF MODELS



4. EXAMPLES OF MODELS



6. GENERAL NOTES

- *PROCESSING WORK*

STUDENTS WISHING TO RUN A MODEL SHOULD BRING THE PRE-CHECKED STL FILE TO ME. THE JOB WILL BE PRICED AND THE STUDENT CHARGED FOR THE MODEL BEFORE IT IS SENT TO THE MACHINE FOR PROCESSING. (SEE SECTION ON COSTING AND CHARGING BELOW). JOBS WILL BE PROCESSED ON A FIRST-COME-FIRST-SERVED BASIS.

- *COSTING AND CHARGING*

MODELS ARE CHARGED ON A TIME BASIS AT A RATE OF £3.50 PER HOUR. THIS IS PAID VIA THE PALMS SYSTEM USING FUNDS STORED ON YOUR ID CARD. TO CHARGE YOUR CARD, PLEASE USE ONE OF THE MACHINES LOCATED ON P1 BY THE COMPUTER HELP DESK, OR IN THE LIBRARY. YOU CAN ALSO TRANSFER MONEY TO YOUR ID CARD BY UNIPURSE ON THE UNIVERSITY WEBSITE.

A PRECISE CALCULATION OF THE TIME THE MODEL WILL TAKE TO PRODUCE IS MADE BY THE SOFTWARE BEFORE IT IS SENT TO THE MACHINE AND USED AS THE BASIS FOR PRICING THE MODEL.

7. LINKS

WWW.DWORKSHOP.ORG

WWW.OPENSTUDIOWESTMINSTER.ORG

8. HEALTH & SAFETY

IN THE CASE OF AN EMERGENCY PLEASE CALL 5555.

REPORT ANY ACCIDENTS, SPILLAGES OR BREAKAGES TO THE TECHNICIAN ASAP.

MODEL MAKING IS AN ENJOYABLE HOBBY BUT, LIKE ANY ACTIVITY THAT INVOLVES TOOLS AND CHEMICALS, IT CAN PRESENT DANGERS IF PRECAUTIONARY ADVICE IS IGNORED. ALWAYS FOLLOW DIRECTIONS, INSTRUCTIONS AND HEALTH AND SAFETY ADVICE GIVEN.

PROTECT YOUR EYES WITH SAFETY GOGGLES IF NECESSARY.

DUST FROM CUT MATERIALS AND FUMES CAN BE HARMFUL IF INHALED. WORK IN WELL VENTILATED AREAS AND USE A PROTECTIVE MASK.

WHEN USING CUTTING TOOLS ALWAYS CUT AWAY FROM THE BODY, KEEP FINGERS CLEAR OF CUTTING LINE AND STORE OLD BLADES SAFELY.

MANY MATERIALS ARE FLAMMABLE. DO NOT USE OR STORE THEM BY A HEAT SOURCE.

DO NOT USE ANY TOOLS OR MACHINERY IF YOU HAVE NOT PREVIOUSLY BEEN TRAINED BY THE TECHNICIAN TO DO SO.

IN GENERAL ACCIDENTS ARE MORE LIKELY TO HAPPEN WHEN YOU ARE DISTRACTED OR IN A RUSH, SO PLEASE TRY TO CONCENTRATE ON THE WORK YOU ARE DOING AND DON'T LEAVE YOUR WORK FOR THE LAST MINUTE.

DON'T DISPOSE ANY TOXIC SUBSTANCE OR MATERIAL IN THE TOILETS OR SINKS, THAT COULD HARM THE ENVIRONMENT, CAUSE PIPE BLOCKAGE, AS WELL AS HURT SOMEBODY.