Development of Low Cost Inkjet 3D Printing for the Automotive Industry

A thesis presented in partial fulfilment of the requirements for a degree of

Master of Engineering in Mechatronics

Massey University, Albany, New Zealand

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2017

Abstract

The aim of this project is to develop a low cost, powder based 3D printer that utilises inkjet printing technology. The 3D printer uses a standard drop-on-demand inkjet print head to deposit a binder onto the powder bed one layer at a time to build the desired object.

Existing commercial 3D printers that use inkjet technology are large and expensive. They do not allow much control to adjust printing parameters, meaning it is difficult to conduct research with different materials and binders. Due to these factors it is not viable to use one for research purposes.

The automotive industry uses 3D printing technology heavily throughout the prototyping process, some manufacturers have even started using the technology to produce functional parts for production vehicles. Ford Motor Company helped develop 3D printing technology and brought it to the automotive industry while multiple university's in America were researching the technology.

Based off an open source design, the printer developed in this project has been customised to allow full control over printing parameters. The body of the printer is laser cut from acrylic. All mechanical components are off the shelf items wherever possible to keep costs down and allow the print area to be easily scaled. Binder is deposited with an HP C6602A print head which is filled with regular black printer ink. The ink is deposited onto a bed of 3D Systems VisiJet PXL Core powder. Custom made parts manufactured in house allow for the print head to be easily changed to whatever is needed. The print head used is refillable and can therefore be filled with custom binders.

With the 3D printer developed in house, all aspects can easily be adjusted. Having full control over printing parameters will allow research to be conducted to develop new 3D printable powders and binders, or to improve the printing quality of existing powders and binders.

The 3D printer has also been developed so that it is easy to adapt to other features to increase its capabilities. With the addition of a UV light source, UV curable binders could be researched; or with the addition of a laser, powder sintering could be researched.

Acknowledgements

I would like to thank all of those who have supported me in any way throughout this project. Firstly, I would like to thank my family for supporting and helping me strive to be the best I can be. Without their love and support I would not be where I am today.

Secondly I would like to thank my supervisor Associate Professor Johan Potgieter. His support and guidance on both an academic level as well as personal has allowed me to successfully complete this project.

Thirdly I would like to thank the NZ Product Accelerator group for providing financial support, without which this project could not have been completed.

Lastly I would like to thank the staff of the School of Engineering and Advanced Technology at Massey University for ideas and guidance throughout this project.

Contents

List of Figures

List of Tables

Abbreviations

ABS	Acrylonitrile butadiene styrene
AM	Additive Manufacturing
CAD	Computer Aided Design
CIJ	Continuous Inkjet Coding
CJP	ColourJet Printing
DMP	Direct Metal Printing
DOD	Drop On Demand
DPI	Dots Per Inch
EBM	Electron Beam Melting
FDM	Fused Deposition Modelling
GUI	Graphic User Interface
LOM	Laminated Object Manufacturing
MJP	MultiJet Printing
PCB	Printed Circuit Board
PLA	Polylactic Acid
RP	Rapid Prototyping
SLM	Selective Laser Melting
SLS	Selective Laser Sintering
SLA	Stereolithography

SPI	Serial Peripheral Interface
STL	Stereolithography (file format)