# NUMERICAL MODELLING ON THE EFFECTS OF FLOW RATES TO THE VELOCITY PROFILES IN SERPENTINE MICROFLUIDIC STRUCTURE

**MOHD YUSSOF BIN SUDIN**

**(2017282226)**

**BACHELOR OF MECHANICAL ENGINEERING (MANUFACTURING) (HONS)**

**UNIVERSITI TEKNOLOGI MARA (UiTM)**

**AUGUST 2020**

“I declared that this is the result of my own work except the ideas and summaries which I have clarified their sources. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any degree. “

Signed : ……

Date : ….....

**MOHD YUSSOF BIN SUDIN**

UiTM No : 2017282226

" I declared that I read this thesis and in our point of view this thesis is qualified in term of scope and quality for the purpose of awarding the Bachelor of Mechanical Engineering (Manufacturing)(Hons)."

Signed : ……

Date : ….....

Supervisor of Project Advisor

**DR. ING AZMI MOHAMED YUSOF**

Faculty of Mechanical Engineering

Universiti Teknologi MARA (UiTM)

13500 Permatang Pauh

Pulau Pinang

## ACKNOWLEDGEMENT

In the name of Allah the most gracious, the most merciful

First and foremost, I would like to to express his gratitude to Allah for making the Final Year Project (FYP) a sucessful and beneficial one for him. Not forgotten my family and my friends as main moral supporters throughtout the progress of this Final Year Project.

I must give my high respectful gratitude to my supervisor, Dr Ing Azmi bin Mohamed Yusof, for the guidance, supervision and help throughout this project. I have learned a lot throughout this semester, with many challenging yet valuable experience in order to complete this Final Year Project. My endless thanks to Dr Azmi for giving me the chance to explore a new knowledge of mine, as well as for giving me precious advices in order to improve myself to become a better person.

I would like to thanks my dear friends and colleagues, especially fellow student Bachelor of Mechanical Engineering (Manifacturing)(Hons), it has been great to know all of you during my time here in UiTM Permatang pauh. Finally, a big thanks goes to my colleagues Adam Ishak for providing me source image for this study, as well as his guidance when I was starting this project.

## ABSTRACT

In this modern era, the development of microfluidic technology applies itself to getting the laboratory-based device into the real environment for end-user applications. Flow focusing as can be seen in the application of flow cytometry is achievable through hydrodynamic flow, dielectrophiresis or using inertia force. This work leverages the effect of inertia force in curved microchannel to assist the generation of flow focusing. The fundamental issues in inertia focusing is to identify the flow velocity (represents the flow rates) to initiate the secondary flow formation in the channel. The main objective of this project is to study the effect on+ the velocity profile in the microchannel at different flow rates and the formation of the secondary flow in the channel. The research will be performed with a microfluidic channel configuration consisting of 5 curvatures with a tipping angle of 20º. ANSYS Fluent software will be used to construct the design and tested by using four volume flow rates which are 10 µL/min, 50 µL/min, 100 µL/min and 200 µL/min. ANSYS fluent can generate the result of streamline, vector and contour. From the result, the scalar velocity from each cross-section in the channel will generate a velocity flow profile and Dean Vertices. At Q 50 µL/min, Secondary flow already occur at Dean number = 5.62. Increasing the volume flow rate will have an impact on the performance and stability of secondary flow.