

UNIVERSITI TEKNOLOGI MARA

**COMPARATIVE DESIGN STUDY OF PIPELINE
GEOMETRIES USING
CUBIC B-SPLINE CURVES AND
TRIGONOMETRIC B-SPLINE CURVES**

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TABLE OF CONTENTS

CHAPTER 1 INTRODUCTION	13
1.1 Introduction	13
1.2 Research Background	13
1.3 Problem Statement	14
1.4 Research Question	14
1.5 Research Objectives	15
1.6 Significance of Study	15
1.7 Limitation	16
1.8 Thesis Scope	16
1.9 Definition of Terms and Concepts	18
 CHAPTER 2 LITERATURE REVIEW	 19
2.1 Introduction	19
2.1.1 Computer Aided Generated Diagram (CAGD)	19
2.2 B-spline	19
2.2.1 Cubic B-splines Curve	20
2.2.2 Trigonometric B-splines curve	20
2.3 Role of Pipeline Geometry in Fluid Flow	21
2.4 Comparison of CBS vs CTBS in Literature	22
2.5 Shape Parameter λ	23
2.6 CFD and Analytical Methods for Pipeline Evaluation	23
2.7 Research Gap & Limitations of Existing Work	24
2.8 Conclusion	24
 CHAPTER 3 RESEARCH METHODOLOGY	 26
3.1 Introduction	26
3.2 The Cubic Trigonometric B-Spline (CTBS) Method	26
3.2.1 Properties of Cubic Trigonometric B-Spline (CTBS)	27
3.2.2 Shape Parameter of Cubic Trigonometric B-Spline (CTBS)	28
3.3 The Cubic B-Spline (CBS) Method	30

3.3.1	Properties of Cubic B-Spline (CBS)	31
3.3.2	Visualisation Cubic B-Spline (CBS)	32
3.4	Translation Method	34
3.5	Pipeline performance Metric	36
3.5.1	Curvature Evaluation	36
3.5.2	Pipe Length Computation	37
3.5.3	Pressure Evaluation	38
3.5.4	Velocity Distortion	38
3.6	Conclusion	39
CHAPTER 4 IMPLEMENTATION		40
4.1	Introduction	40
4.2	Researcher Step	40
4.3	Conclusion	60
CHAPTER 5 RESULT		61
5.1	Introduction	61
5.2	Result and Analysis	61
5.2.1.	Analysis of CTBS curve of test objects	61
5.2.2.	Analysis of CBS curve of test object	62
5.2.3.	Analysis of 3D curve of test object	63
5.2.4.	Analysis of Curve for The Real Object	65
5.2.5.	Analysis of 3D curve of real object	66
5.2.6.	Analysis of CPU time	68
5.2.7.	Analysis of Pipeline Performance	69
5.3	Conclusion	75
CHAPTER 6 CONCLUSION AND RECOMMENDATION		76
6.1	Introduction	76
6.2	Conclusion	76
6.3	Recommendation	77

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ABSTRACT

Pipeline design plays a crucial role in fluid transport efficiency, as pipeline geometry directly influences flow behaviour, including pressure loss and velocity distribution. This study presents a comparative analysis of pipelines modelled using cubic B-spline (CBS) and cubic trigonometric B-spline (CTBS) curves. Control points were employed to define the pipeline geometries, and the resulting curves were analysed to assess their suitability for fluid flow applications. Computational simulations were performed to evaluate pressure loss and velocity distribution within the pipelines, providing a basis for performance comparison. The results indicate that CTBS-based pipelines exhibit smoother directional transitions and lower pressure losses compared to CBS-based designs, while CBS offers higher geometric accuracy in shape representation. These findings suggest that CTBS has the potential to enhance pipeline flow performance. Overall, this study emphasises the importance of curve selection in pipeline design and provides a systematic framework for improving pipeline geometry using advanced B-spline techniques.