COMPARISON OF B-SPLINE CURVE FITTING OF CUBIC TRIGONOMETRIC B-SPLINE WITH SHAPE PARAMETER AND NON-UNIFORM RATIONAL B-SPLINE

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Thesis submitted in fulfilment
of the requirement for the degree of
Bachelor of Science
Mathematical Modelling and Analytics (Hons.)

College of Computing, Informatics and Mathematics
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February 2025

ABSTRACT

B-splines are commonly used functions in geometrical design. Their ability to smoothly approximate curves with various methods makes them highly valuable in shape design. This paper aims to compare cubic trigonometric B-splines (CTBS) and non-uniform rational B-splines (NURBS) in curve design. Using Wolfram Mathematica, this research begins by implementing both methods on various test objects with simple curves and a limited number of control points. Then, the comparison of shape parameters (for CTBS) and weights (for NURBS) was made to determine which best define the curve shape which shows that $\lambda = 0.1$ and $w = 10$ resulted the smoothest curve for CTBS and NURBS respectively. Next, the shape parameters for CTBS and weights for NURBS are utilized to design more complex objects with a larger number of control points which is Keris with 118 control points and 39 curves. The comparison of the performance of both methods was made using mean squared error (MSE), a statistical measurement to quantify the error between the desired curve and the generated curve which resulted that the NURBS curve's MSE is lower than CTBS curve's MSE. Furthermore, this study develops interactive applications using Wolfram Mathematica for both CTBS and NURBS. These applications demonstrate the flexibility and applicability of each curve type to users. This study concludes by analyzing the smoothness of the curves generated by both CTBS and NURBS, as well as the accuracy of their error terms.

ACKNOWLEDGEMENT

In the name of Allah, Most Gracious, Most Merciful. Praise to be to Allah, the Cherisher and Sustainer of the world. Foremost, I would like to thank Madam Nursyazni Binti Mohamad Sukri for her valuable guidance, continuous support, and constructive criticisms during the process of carrying out the research and preparing this thesis. Her knowledge and motivation have been major contributors to the development of this work. I would like to extend my heartfelt gratitude to Dr. Nur Atikah, my lecturer for the subject MSP660, for her outstanding teaching and academic leadership, which have significantly enhanced my knowledge in spline theory and computer-aided design techniques. In addition, I would like to extend my gratitude to the facilitation provided by the staff of Universiti Teknologi Mara, which has allowed me to further my studies. I am thankful to my colleagues and friends who have supported me throughout this academic pursuit with their encouragement and discussions. Their experience and friendship have added value to this work. I would also like to thank all those who have directly or indirectly contributed to this research effort. Last but not least, I nostalgically remember the regular motivation and unrelenting support given to me by my family.

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