

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

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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.

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