

## WAT RATIONAL CUBIC TRIGONOMETRIC BEZIER CURVES AND ITS APPLICATIONS

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### ABSTRACT

In this paper, a kind of Rational cubic Bézier curves by combining algebraic polynomials and trigonometric polynomials, using the weight method is developed, named weight algebraic trigonometric (WAT) Rational Bézier curves. Here, weight coefficients are referred as shape parameters, which are called weight parameters. The value of weight parameters can be extended to the interval  $[0, 1]$  to  $[-2, 2.33]$ , and the corresponding WAT Rational Bézier curves and surfaces are defined. The WAT Rational Bézier curves inherit most of properties similar to those of Cubic Bézier curves, and can be adjusted easily by using the shape parameter  $\lambda$ . The jointing conditions of two pieces of curves with the  $G^2$  and  $C^2$  continuity are discussed. With the shape parameter chosen properly, the defined curves can express exactly in the form of plane curves or space curves defined by a parametric equation based on  $\{1, \text{Sint}, \text{cost}, \text{sint}2t, \text{cos}2t\}$  and circular helix and ellipse, with a high degree of accuracy without using rational form. Examples are given to illustrate that the curves and surfaces, which can be used as an efficient new model for geometric design in the fields of CAGD. It is clear that the existing techniques based on C-Bézier spline can approximate the Bézier curves only from a single side, the WAT Rational Bézier curves can approximate the Bézier curve from both the sides, and the change range of shape of the curves is wider than that of C-Bézier curves. It is important that this WAT Rational Bézier curves much be closer to the control point, compared to the other spline curves. The geometric effect in case of shape preservation of this weight parameter is also discussed.

**KEYWORDS:** Bézier Curves and Surfaces, Trigonometric Polynomial, Shape Parameter,  $G^2$  and  $C^2$  Continuity