

Cubic Spline Interpolations in CNC Machining



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Abstract A cubic spline polynomial is applied to control the machine tool movements defined by the spline. This paper is an attempt to implement cubic spline interpolation in computer numerical method (CNC) machining. Three different C++ interpolation libraries were studied: Boost, Alglib and TK spline. The goals are to compare the accuracy of interpolation and the ease of implementation of the libraries. Twenty cubic spline interpolant functions were calculated using a selected test function. One thousand interpolated points were calculated using the three different cubic spline interpolation libraries. Based on findings in this work, the Boost library is best on accuracy based on RMSE (root mean square error), while the TK spline library is simplest to implement in software code. The Alglib library is the most complicated in setup, and its accuracy is similar to the TK spline library. Included at the end of this report are the C++ cubic spline source codes, results of code executions and visual plots confirming the correctness of this work.

Keywords Spline · Cubic · Polynomial · Interpolation · Computer numerical method

1 Introduction on Interpolation

CNC controller works on interpolation and extrapolation principles. The prediction of a point between two known points coordinate known as interpolation. While extrapolation is an estimation of a point subjected on a known sequence of points coordinate. In CNC programming applications, most of interpolation algorithms is linear which is used for straight-line machining between two points. Circular interpolation is used for circles and arcs while helical interpolation, used for threads and helical forms.

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