

Admissible curvature continuous areas for fair curves using G^2 Hermite PH quintic polynomial

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Abstract

In this paper we derive admissible curvature continuous areas for monotonically increasing curvature continuous smooth curve by using a single Pythagorean hodograph (PH) quintic polynomial of G^2 contact matching Hermite end conditions. Curves with monotonically increasing or decreasing curvatures are considered highly smooth (fair) and are very useful in geometric design. Making design by using smooth curves is a fascinating problem of computing with significant physical and aesthetic applications especially in high speed transportation and robotics. First we derive sufficient conditions for curvature continuity on a single PH quintic polynomial with given Hermite end conditions then we find the admissible area for the smooth curve with respect to the curvatures at its endpoints.

Key words: Motion planning, Transportation, Pythagorean hodograph (PH), Quintic polynomial, G^2 Hermite, Monotone, Curvature

1 Introduction

It is often desirable to have curvature continuous smooth curves of G^2 contact matching Hermite end conditions, i.e., spiral segments, in geometric design of curves and surfaces. The purpose may be aesthetic applications in information technology [2], practical applications such as in robotics, GIS, CAD systems, animations, environmental design, collision avoidance, animations, satellite path planning, highway/railway design and other disciplines [6, 20, 9, 16].

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