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SIGNATURE CURVES STATISTICS OF DNA SUPERCOILS

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Abstract. In this paper we describe the Euclidean signature curves for two dimensional closed curves in the plane and their generalization to closed space curves. The focus will be on discrete numerical methods for approximating such curves. Further we will apply these numerical methods to plot the signature curves related to three-dimensional simulated DNA supercoils. Our primary focus will be on statistical analysis of the data generated for the signature curves of the supercoils. We will try to establish some relationships between the statistics and the shape of the signature curve. The hope is that these findings will provide a more efficient way for computers to search for and identify signature curves corresponding to similar DNA supercoils.

1. Introduction

When one begins the examination of signature curves, it is helpful to understand why they are so important. Signature curves are most useful in the study of computer vision applications because they allow any object to be represented by a unique curve which is invariant under Euclidean transformations such as rotation. The ability for a computer to *view* objects as invariant curves holds much promise for future developments in the field of artificial intelligence. Signature curves can also be used in medical imaging devices such as CAT or MRI scans. There are also many military and civil defense systems that can employ the use of signature curves for object recognition purposes. Signature curves can be calculated for curves that are described by functions algebraically but this process can be difficult as the calculations get very tedious. However they can simply be created numerically by methods described by Calabi *et al*, [2]. These numerical methods can also be applied to find the signature curves of an image taken with a camera or other imaging device. One can find the boundary of such an image using a segmentation algorithm such as the method of active contours or snakes described in [4], and thereby create the corresponding signature curve.