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基于非均匀Catmull-Clark细分方法的曲线插值

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Abstract
Generating subdivision surfaces with complicated curve interpolation constrains is a concerned topic for computer graphics and geometric modeling. In this paper an efficient method that can interpolate cubic NURBS curves is proposed for generating the subdivision surfaces. A 'symmetric zonal mesh' is constructed by designing symmetric quadrilaterals for both sides of the control polygon of the interpolated curve. Applying the non-uniform Catmull-Clark subdivision scheme proposed by Sederberg et al. to the symmetric zonal mesh, it is proved that the mesh can converge to the interpolated curve. As a result, the limit surface of the polygonal mesh containing the symmetric zonal meshes is the subdivision surface satisfying the curve interpolation constrains. This algorithm can interpolate both the single NURBS curve and the curve mesh consisting of several NURBS curves. Therefore it can be widely used for product shape design and graphic software development.

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摘要
带有复杂型曲线插值约束的细分曲面的生成,是计算机图形学及几何造型技术等领域所关心的一个问题.鉴于此,提出了一种高效的可以插值三次NURBS曲线的细分曲面生成方法.只需在被插值曲线的控制多边形两侧构造具有对称性质的四边形,构成对称网格带;证明了对该对称网格带应用Sederberg等人提出的非均匀Catmull-Clark细分规则以后,它将收敛于这条被插值曲线.因此,含有这种对称网格带的多面体网格的细分极限曲面即为满足曲线插值约束的细分曲面.应用该方法,既可以插值单条NURBS曲线,也可以插值由多条NURBS曲线组成的曲线网格.因此,该方法广泛适用于产品外形和图形软件设计.

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