Catmull-Rom 图像缩放算法的自适应结构设计与实现

任向隆 1，2 ，田 泽 1，2 ，张 骏 1，2 ，韩立敏 1，2 ，郑新建 1，2 ，范飞虎 1

（1 中国航空工业集团 西安航空计算技术研究所，陕西 西安 710068;

2 集成电路与微系统设计航空科技重点实验室，陕西 西安 710068）

摘 要：为解决传统 Catmull-Rom 缩放结构因行列计算量比例不协调导致行/列插值部件长期停顿而造成的性能低下问题，提出了两种自适应结构.在传统结构的基础上增加三个插值部件，并结合两种自适应策略，分配新增插值部件用于行或列插值，并对处于工作状态的插值部件的数量进行调整，得到两种自适应结构.实验表明：与传统结构相比，结构一各类资源占用为原来的 1~2.5 倍，而性能提高最大为原来的 3.99 倍，但仅在缩小时存在性能提升，适用于仅存在缩小的场合（如纹理的 MIPMAP）；结构二各类资源占用为原来的 1.7~2.5 倍，而性能提高最大为原来的 3.98 倍，在缩小与放大时均存在性能提升，适用于放大缩小同时存在的场合（如图像的缩放）.

关键词：Catmull-Rom；缩放；自适应结构；插值部件

Design and implementation of adaptive architecture for

Catmull-Rom image scaling algorithm

REN Xiang-long 1,2 ，TIAN Ze 1,2 ，ZHANG Jun 1,2 ，

HAN Li-min 1,2 ，ZHENG Xin-jian 1,2 ，FAN Fei-hu 1

(1 Aeronautical Computing Technique Research Institute,AVIC， Xi'an 710068, China;

2 Key Laboratory of Aviation Science and Technology on Integrated

Circuit and Micro-System Design, Xi′an 710068, China)

Abstract：Two adaptive structures are proposed to conquer the low performance caused by long-term pause of the row and column interpolation components in traditional structures of Catmull-Rom, when operations between row and column not suitable. In the two adaptive structures, three interpolators were added on the basis of traditional structure, along with two adaptive strategies which could allocate interpolators between row and column and adjust the number of them at working. The result of experiment is as follows. Compared with the traditional structure, the first structure achieved up to 3.99 times performance improvement, while resources occupy between with 1 to 2.5 times, and the performance improvement achieved only when scaling down, suitable for cases of shrinking only, such as MIPMAP of texture; The second structure achieved up to 3.98 times performance improvement, while resources occupy between with 1.7 to 2.5 times, and the performance improvement achieved when scaling up as well as scaling down, suitable for occasions of scaling up and down, such as image zooming.

Key words：catmull-rom; scale; adaptive architecture; interpolation unit