International Journal of Innovative
Computing, Information and Control
Volume 4, Number 8, August 2008

 ISSN 1349-4198
pp. 1887–1896

INTERACTIVE MODEL DECOMPOSITION USING PROTRUSIVE GRAPH

Yu-Shuen Wang[1], Chao-Hung Lin[2] and Tong-Yee Lee[1*]

[1]Department of Computer Science and Information Engineering
[2]Department of Geomatics
National Cheng-Kung University, Taiwan
[1*]tonylee@mail.ncku.edu.tw; [2]linhung@mail.ncku.edu.tw

Received July 2007; revised November 2007

Abstract. *In this paper, we propose an interactive model decomposition scheme. In preprocess, we automatically build a protrusive graph for any given 3D model. The purpose of the Protrusive Graph gives the user a good clue in partitioning the model into visually significant parts. This scheme can then interactively partition models according to the user-specified partitioning requirements. Finally, iterative clustering is used to stabilize our partitions and a smoothing refinement is used to smooth the boundary between adjacent partitions. The experimental results show that the proposed scheme is a flexible and powerful method of decomposing models into their significant components.*
Keywords: Mesh decomposition, Protrusive graph, Clustering

1. **Introduction.** Model decomposition plays an important role in many mesh related algorithms including mesh editing [1] and deformation, parameterization [2], metamorphosis [3-7], texture mapping [8], compression [9], and skeleton extraction [10]. Shamir [11] presents an excellent survey of mesh decomposition schemes. Most of the previous schemes either used clustering or region-growing approach to find partitioning. Their main differences lie in the similarity metrics, which are used to group similar sub-meshes and finding the borders between clusters. These useful metrics include curvature [12], geodesic and angular distances [10], motion [13-14], and spectral [9] information. Without a careful treatment of local concavities, some algorithms are prone to generate over-segmentation. A fuzzy clustering approach [10] can avoid this problem and cut the model into meaningful components. Later, in [15], multi-dimensional scaling representation and spherical mirroring operation is used to deal with pose-invariant mesh segmentation. Most of these algorithms fall under the category of automatic mesh decomposition. On the other hand, intelligent mesh scissoring [16] is a good semi-automatic approach. However, to perform manual scissoring on a mesh part by part, feature contours must be selected from many candidate contours step by step. This procedure can be tedious, labor intensive work.

Sometimes, a fully automatic algorithm cannot always guarantee desirable model decomposition. In particular, for some applications such as mesh editing, a fully automatic method may be not as important as giving the user more control over mesh partitioning in a more intuitive or natural manner. An easy-to-use semi-automatic method is needed. In this paper, we present an interactive model decomposition scheme that makes the following contributions:

- We automatically build a protrusive graph (PG) for a given model to identify all possible visually-protrusive parts.