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3D TRIANGLE MESH COMPRESSION BASED ON VECTOR QUANTIZATION WITH *k*-RING VECTOR PREDICTION

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Abstract. *The transmission and storage of large amounts of triangle and vertex geometry data are required for rendering geometrically detailed 3D meshes. To alleviate bandwidth requirements, this paper uses vector quantization (VQ) as an effective lossy vertex data compression technique for triangle meshes with high rate-distortion performance. The proposed novel VQ-based vertex encoding algorithm adopts a region growing based k-ring prediction scheme. During the encoding process, the value k related to the current vertex to be encoded is estimated by the prediction errors of the preceding encoded vertices, and then the adaptive prediction rule for the current vertex is obtained according to the value k. Therefore, the dynamic range of the residual vectors generated by the proposed prediction scheme is reduced. Thus it is expected to achieve a higher quantization quality with the same codebook size. Experimental results show that, compared with the vertex encoding algorithm based on the conventional parallelogram prediction scheme, the proposed algorithm can achieve a higher encoding quality at the same bit rate.*
Keywords: Computer graphics, 3D meshes, Vertex data compression, Vector quantization, k-ring prediction

1. **Introduction.** Interactive 3D graphics plays an important role in various fields such as entertainment, manufacturing and virtual reality. When combining the graphics technology with the Internet, the transmission delay for 3D graphics data is becoming a major performance bottleneck, especially for meshes consisting of millions of triangles. Under the limited network bandwidth, as well as the storage problem within host systems, reducing the amount of data is, go without saying, an effective solution. Consequently, the interests in compression techniques for the 3D geometry data have surged in recent years.

Although many representation methods for 3D meshes exist, a triangle is the basic geometric primitive for standard 3D graphics applications, graphics rendering hardware and many simulation algorithms, and any other surface based representations can be easily converted into triangle meshes. Triangle meshes are composed of two components: vertex data and connectivity data. Vertex data mainly include the positional coordinates