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Sharpen&bend: Recovering curved sharp edges in triangle meshes produced by feature-insensitive sampling

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Abstract: Various acquisition, analysis, visualization, and compression approaches sample surfaces of 3D shapes in a uniform fashion without any attempt to align the samples with sharp edges or to adapt the sampling density to the surface curvature. Consequently, triangle meshes that interpolate these samples usually chamfer sharp features and exhibit a relatively large error in their vicinity. We present two new filters that improve the quality of these resampled models. EdgeSharpener restores the sharp edges by splitting the chamfer edges and forcing the new vertices to lie on intersections of planes extending the smooth surfaces incident upon these chamfers. Bender refines the resulting triangle mesh using an interpolating subdivision scheme that preserves the sharpness of the recovered sharp edges while bending their polyline approximations into smooth curves. A combined Sharpen&Bend postprocessing significantly reduces the error produced by feature-insensitive sampling processes. For example, we have observed that the mean-squared distortion introduced by the SwingWrapper remeshing-based compressor can often be reduced by 80 percent executing EdgeSharpener alone after decompression. For models with curved regions, this error may be further reduced by an additional 60 percent if we follow the EdgeSharpening phase by Bender.

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