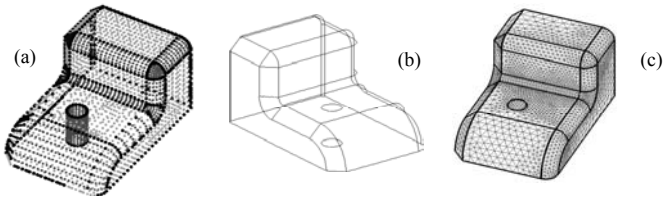
IMPROVING SURFACE REMESHING BY FEATURE RECOGNITION

A. Rassineux, C.Chappuis, P. Breitkopf, P . Villon

Université de Technologie de Compiègne,
Laboratoire Roberval, UMR CNRS-UTC 6066
alain.rassineux@utc.fr, cedric.chappuis@utc.fr, piotr.breitkopf@utc.fr,pierre.villon@utc.fr

We propose in this paper a method to identify on a mesh, simple geometric primitives commonly used in mechanical parts (plane, sphere, cylinder, torus, cone) in order to improve the quality of the remeshing. We have already presented a method to adapt an existing surface mesh based on a meshfree technique. Denoted as Diffuse interpolation. A secondary local geometrical model is built from the mesh to achieve the adaptation. Sharp edges are determined with respect to angles between neighboring elements. We experienced that in many cases some feature lines could not be detected by a simple geometrical criterion (connecting fillets, for instance).
The four main steps of the method can be described as follows:
1. The fist step is a segmentation step (figure a) based on curvature estimate in which data points are grouped into sets each belong to a different surface. A local surface equation using the nodes of the initial mesh is calculated. The form of surface suited to the local diffuse interpolation is denoted as Monge patch of equation $z=f(x,y)$ where f is a C^2 function defined on a planar domain.
The determination of this equation enables us to perform an accurate computation of the principal curvatures which are used thereafter in order to classify the points into subset corresponding to surface type: Planes, cylinders, spheres, cones and tori. Some difficulties arise when points are located at the frontier of surfaces of different types or when the set of data point is anisotropic. A strategy of research of the interpolation set in the Moving Least Square Approximation is proposed. The method is based on the determination of the convex hull and on a specific computation of the weighting functions. This strategy coupled with a region growing algorithm enables us to guarantee a reliable segmentation process.
2. When all points have been gathered into homogeneous sets, geometrical parameters of the underlying continuous model (such as a radius) are identified by a. performing a least square fitting technique.
3. The next step is a registration step in which a topology (figure b)) of the model is created. This is achieved by defining a priority criterion depending on the surface type and on the number of points between adjacent surfaces. Some a priori geometrical assumptions are also made on the model: cocentricity, coaxiality, parallelism, orthogonality.
4. The final step consists in meshing or remeshing the model (figure c).



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