

METHOD AND SYSTEM FOR COMPARING 3D MODELS

Field of the Invention

[0001] This patent application relates to the field of 3D models, as an example to the digital representations in a space of dimension 3, and more particularly to the field of 3D models comparison, such as using descriptors, for the purposes of a search, a ranking and/or a comparative analysis of the parties.

Background of the Invention

[0002] Objects' Tri-dimensional (3D) digital representations of are well-known in the fields of engineering, medicine, video game, film, and even in widely spread applications (for example SketchUp by Google, now Trimble). Usage in such fields was made possible by software for 3D creation and edition including CAD systems (computer aided design), for reverse engineering and for other techniques of 3D reconstruction, but also by 3D scanning equipment. All these means generate digital models in dimension 3. None of the said digital models are 3D models describing boundaries between objects and their environment also known as Boundary Representations (B-rep, found for example in the STEP standard or geometric modelers like Parasolid and Acis). Others provide a tessellation (for example STL or VRML formats). These models may include information other than purely geometrical data.

[0003] The above types of 3D models are commonly used in enterprises and in many areas of everyday life, and their number are still quickly increasing. Therefore, a multi-facet problem is arising, i.e. (i) to identify the 3D models, (ii) to find similar digital objects, (iii) to compare them to identify differences or identical parts, and finally (iv) to display relevant results according to a set of criteria to ensure simple and efficient use of the search results.

[0004] Currently, there are two distinct categories of systems. Systems belonging to the first category compare a first 3D model to a second 3D model to determine the differences between them. Systems from the second category find 3D models that are similar to a 3D model given in reference.

3D models comparison systems

Claims

1. A computer implemented method for comparing a reference 3D model with a plurality of 3D models, the computer implemented method comprising:

5 computing a confidence level according to similarities and differences of the geometrical characteristics between a descriptor of the reference 3D model and at least one descriptor of one of the plurality of 3D models, each descriptor comprising a plurality of characteristics associated with at least one face of the 3D model;

10 computing a similarity value using the computed confidence levels between the characteristics of a descriptor of the reference 3D model and the characteristics of at least one descriptor of one of the plurality of 3D models.

2. The computer implemented method of claim 1, further comprising repositioning the plurality of 3D models according to the geometrical characteristics of the reference 3D model.

3. The computer implemented method of claim 2, each descriptor further comprising:

15 geometrical characteristics that are dependent of a coordinate system; and

 geometrical characteristics that are invariant of the coordinate system;

wherein the repositioning of the plurality of 3D models comprises:

20 pairing sub sets of the descriptor of the reference 3D model with sub sets of the at least one descriptor of one of the plurality of 3D models based on the invariant geometrical characteristics of the descriptor of the reference 3D model and on the invariant geometrical characteristics of at least one descriptor of one of the plurality of 3D models;

25 determining groups of transformations to reconcile the pairings using the dependent geometrical characteristics of the descriptor of the reference 3D model and the dependent geometrical characteristics of at least one descriptor of one of the plurality of 3D models;

 identifying a first group of similar transformations from the groups of transformations.

4. The computer implemented method of claim 3, the method further comprising:

 computing a confidence level of each pairing according to similarities and differences between the invariant geometrical characteristics of the descriptor of the reference 3D

model and the invariant geometrical characteristics of the descriptor of one of the plurality of 3D models.

5. The computer implemented method of claim 3 or 4, the step of computing a similarity value using the first group of transformations to identify the similarities and differences.

5 6. The computer implemented method of any one of claims 3 to 5, the method further comprising:

computing a confidence level of each reconciled pair of sub sets of descriptors of the reference 3D models according to similarity of dependent geometrical characteristics of the descriptor of the reference 3D model and the descriptor of one of the plurality of 3D models.

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7. The computer implemented method of any one of claims 3 to 6, the method further comprising the steps of:

identifying a second group of similar transformations from the groups of transformations;

computing a reconciliation confidence level using the second group of transformations;

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identifying the similarities and differences between the reference 3D model and one or more 3D models from the plurality of 3D models using the first and second group of transformations; and

computing a combined similarity value based on the first and second groups of transformations.

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8. The computer implemented method of any one of claims 3 to 7, wherein the geometrical characteristics that are invariant of the coordinate system comprise geometrical characteristics of at least one of: area, perimeter, and the geometrical characteristics that are dependant of the coordinate system comprise geometrical characteristics of at least one of: center of gravity and axes of moments of inertia.

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9. The computer implemented method of any one of claims 1 to 8, wherein the descriptor further comprises G2 continuity geometrical characteristics related to a set of faces having G2 continuity.

10. The computer implemented method of any one of claims 1 to 9, in which a portion of the descriptor is used for the computation of the confidence level.

11. The computer implemented method of any one of claims 1 to 10, in which the descriptor is generated for at least a selected face of the reference 3D model.
12. The computer implemented method of any one of claims 1 to 11, in which the computation of the confidence level is affected by at least one constraint on one or a plurality of characteristics of a 3D model and/or between characteristics of a 3D model.
13. The computer implemented method of claim 12, wherein the constraint is input by an operator.
14. A data processing system configured to achieve the process of comparing more than two 3D model for the purposes of searching for identical or similar 3D models, of determining the similarities and the differences, of classifying, of ranking, of ordering, of sorting, of filtering the 3D models using the method of any one of claims 1 to 13.
15. A process for manufacturing a product, the process characterized by the operation of a 3D model for manufacturing at least a part of the product, the 3D model being directly selected or modified from a selected 3D model using the method of comparison as claimed in any one of claims 1 to 13.