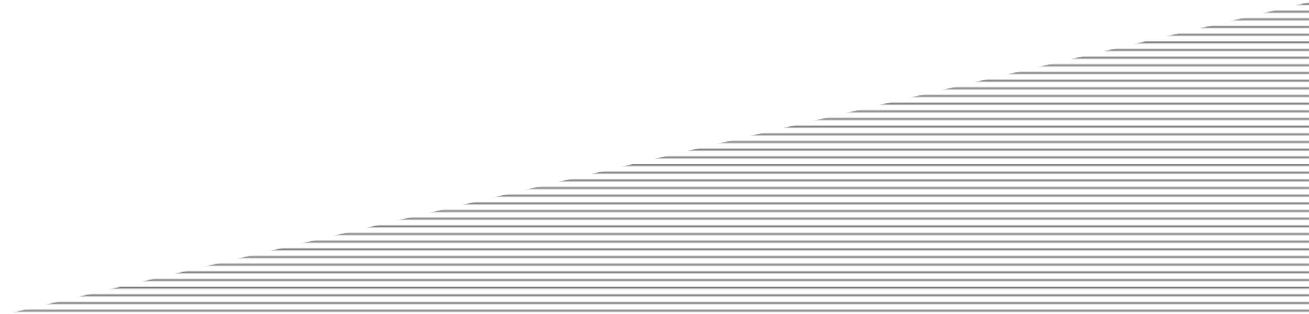# AIM@SHAPE

Advanced and Innovative Models And Tools for the development of Semantic-based systems for Handling, Acquiring, and Processing knowledge Embedded in multidimensional digital objects

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Deliverable D1.2.1

Glossary – 2nd version

Circulation:	[1]**PU**
Partner(s):	**ITI**
Authors:	Chiara Catalano (IMATI), Tor Dokken (SINTEF), Tal Hassner (Weizmann), Marios Pitikakis (ITI), Francesco Robbiano (IMATI), Manolis Vavalis (ITI), Remco Veltkamp (UU)
Contributors:	Marc Alexa (TUD), Ronen Basri (Weizmann), Silvia Biasotti (IMATI), Marie-Paule Cani (INPG), Vincent Cheutet (INPG), Leila De Floriani (DISI), Gershon Elber (Technion), Rosalinda Ferrandes (INGP), Alejandra

Garcia-Rojas (EPFL), Stefanie Hammann (INPG), Francesco Isgrò (DISI), Ioannis Ivrissimtzis(MPII), Laurent Moccozet (MIRALAB), Laura Papaleo (DISI)

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Document History

Vers.	Issue Date	Stage	Content and changes
1	25 Aug. 2004	1 (40%) Draft	First contributions from the ontology clusters.
1	10 Sept. 2004	1 (70%) Draft	Contributions from the remaining ontology clusters and STAR leaders.
1	17 Sept. 2004	1 (100%) Draft	Web version of the glossary.
2	22 July 2005	2 (50%) Draft	Selection of significant terms
2	26 Sept. 2005	2 (100%) Final	2nd version of the glossary
2	16 Mar. 2007	2 (100%) Final	Revision. Terms were added, deleted and edited. Synonyms were added. New user interface.

Executive Summary

This document contains the revision of the second version of the deliverable **D1.3** of the IST NoE AIM@SHAPE. The deliverable **D1.2.1** – Glossary – aims at the definition of a common vocabulary (glossary) which will be used by the Consortium to talk about digital shapes. It is an attempt to have a list of carefully selected terms that are used by the Consortium to deal with digital shapes. A new Glossary web interface has also been implemented that supports searching and browsing through the terms, as well as administration (online insertion, deletion and editing of glossary terms).

The task leader is **ITI** and is actively supported by the Glossary Committee and all the AIM@SHAPE partners.

Table of Contents

1   INTRODUCTION

The objective of this activity is to create a common vocabulary (glossary) of terms concerning digital shapes, which will be used by the Consortium. To this end, a Glossary Steering Committee (composed by Chiara Catalano, Tor Dokken, Tal Hassner, Francesco Robbiano, Manolis Vavalis, and Remco Veltkamp) was set during the Managing Board meeting (which took place at Utrecht in November 2004) with the goal of coordinating and organizing all the activities related to the glossary.

The Glossary Steering Committee, as the experts of different domains, has agreed on a specific strategy for the development of the Glossary, and was in charge of collecting the glossary entries along with their definitions.

In the previous version of the Glossary, a great number of terms have been gathered from different activities of the AIM@SHAPE NoE (i.e. from the domain ontologies, the common ontologies, the state of the art reports, shape metadata, tool metadata and from the Digital Library). However, those terms were at a different level of detail, only a few of them had definitions and there was a lack of homogeneity.

The main decisions made were:

- to heavily reduce the number of terms collected in the previous version of the glossary, keeping only the most significant ones of each domain. In particular, a lot of terms were removed at this stage, which were irrelevant (e.g. "minimum") or not strictly distinctive of our field (e.g. basic mathematical terms like "eigenvalue");

- to provide the definitions of all the remaining terms in the glossary;

- to provide related terms and synonyms for the Glossary terms.

The selection process of the terms is presented in section 2. Section 3 provides a description of the new Glossary Web Interface implementation.

2   THE SELECTED TERMS

The selection of the reduced number of terms was not arbitrary but followed the criteria presented below:

- The term must be meaningful in the domain of digital shapes;

- The term must be distinctive in this domain;

- If the term is clear even without any knowledge of the domain, it should not be included;

- Basic mathematical terms should not be included;

- If a definition of a term cannot be provided at this stage, the term will be temporarily removed and inserted in a later stage.

The resulting list of terms from the above procedure, along with the definitions given and other related terms is presented in Appendix A. Around 370 terms were chosen and included in the Glossary.

3   GLOSSARY WEB INTERFACE

In order to have an easy way to access the Glossary and make it publicly available, a web interface was necessary. The web interface implementation of the previous version of the Glossary was based on TCS-8[2], which is an offline software tool that supports the development of complex controlled vocabularies (thesauri, taxonomies, hierarchies).

Basic administrative tasks were performed as follows:

- The insertion of new terms was made manually (by sending to the Glossary administrator any new terms) or semi automatically (after the addition of new terms, the user had to export the vocabulary in an ASCII format and send it to the Glossary administrator in order to merge it with the rest);

- The glossary publication was performed by using the HTML export utility of TCS-8. The produced HTML pages did not support keyword search and the terms could only be found alphabetically or by browsing different tree hierarchies.

The latest (free) version of TCS[2] (TCS-9) has no significant improvements that could help us inserting and publishing new terms. Since the consortium decided not to provide a thesaurus but only a glossary of terms, we implemented a simpler, more flexible web-based solution (without depending on expensive commercial software). All the terms collected so far were exported in XML format and stored in a database (PostgreSQL). This database solution will also facilitate the integration process with the Digital Shape Workbench and the Search Engine in particular.

We are now in the process of developing a simple ontology for the Glossary and associating this ontology with the other AIM@SHAPE ontologies (i.e. the common ontologies and the domain ontologies).

The AIM@SHAPE Glossary is available at the URL http://dsw.aimatshape.net/glossary/ . There are different ways of searching and browsing the Glossary (see Figure 1). There is a keyword search available (see Figure 2) as well as alphabetically ordered browsing (see Figure 3) or a complete listing of all the Glossary terms.

A web-based glossary administration interface was also developed (using JSP technology) in order to insert (see Figure 4), delete and edit terms. Only selected members of the consortium (i.e. the Glossary Steering Committee) are authorized to update Glossary terms on-line, through the DSW authentication/authorization mechanism.
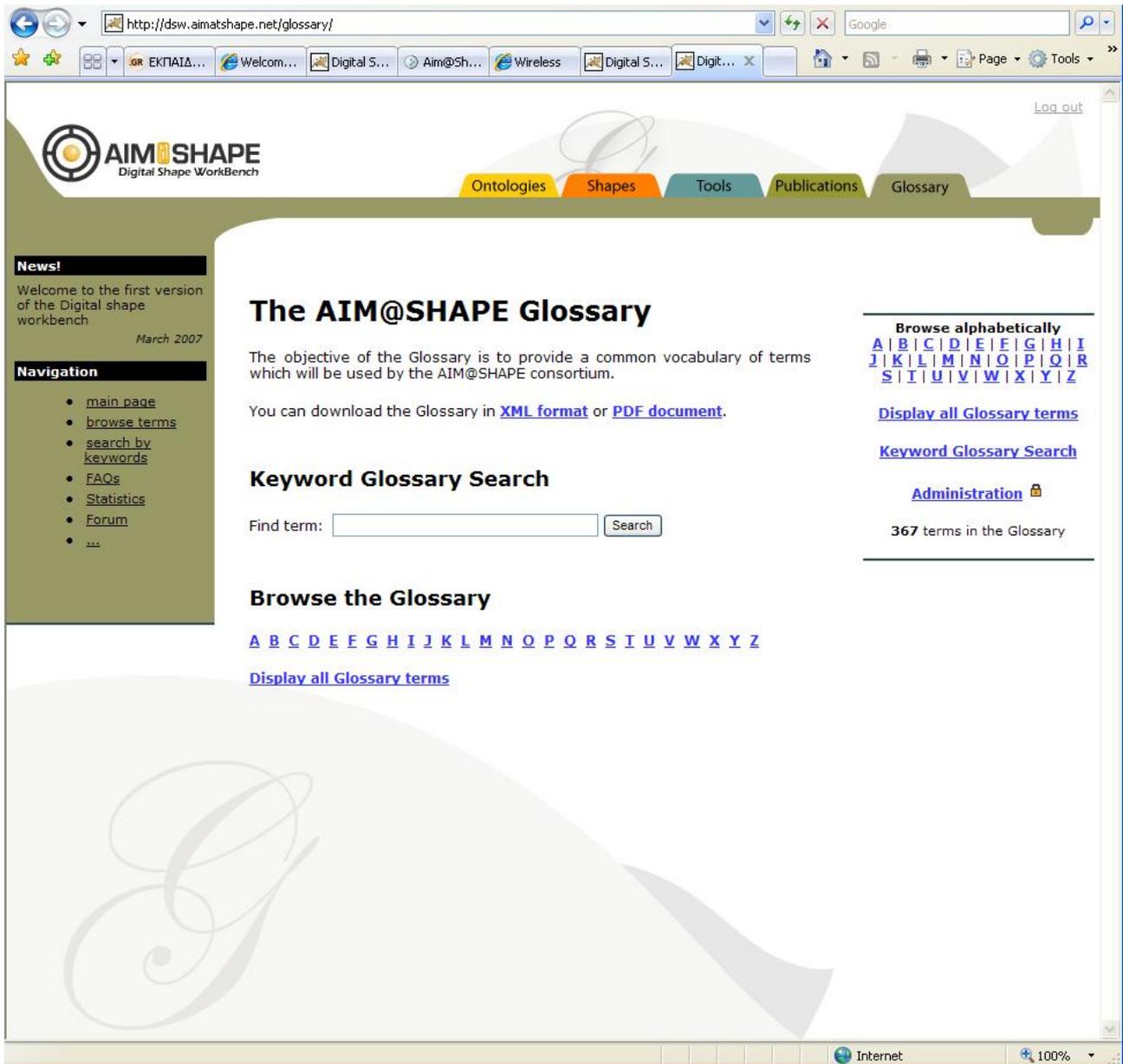

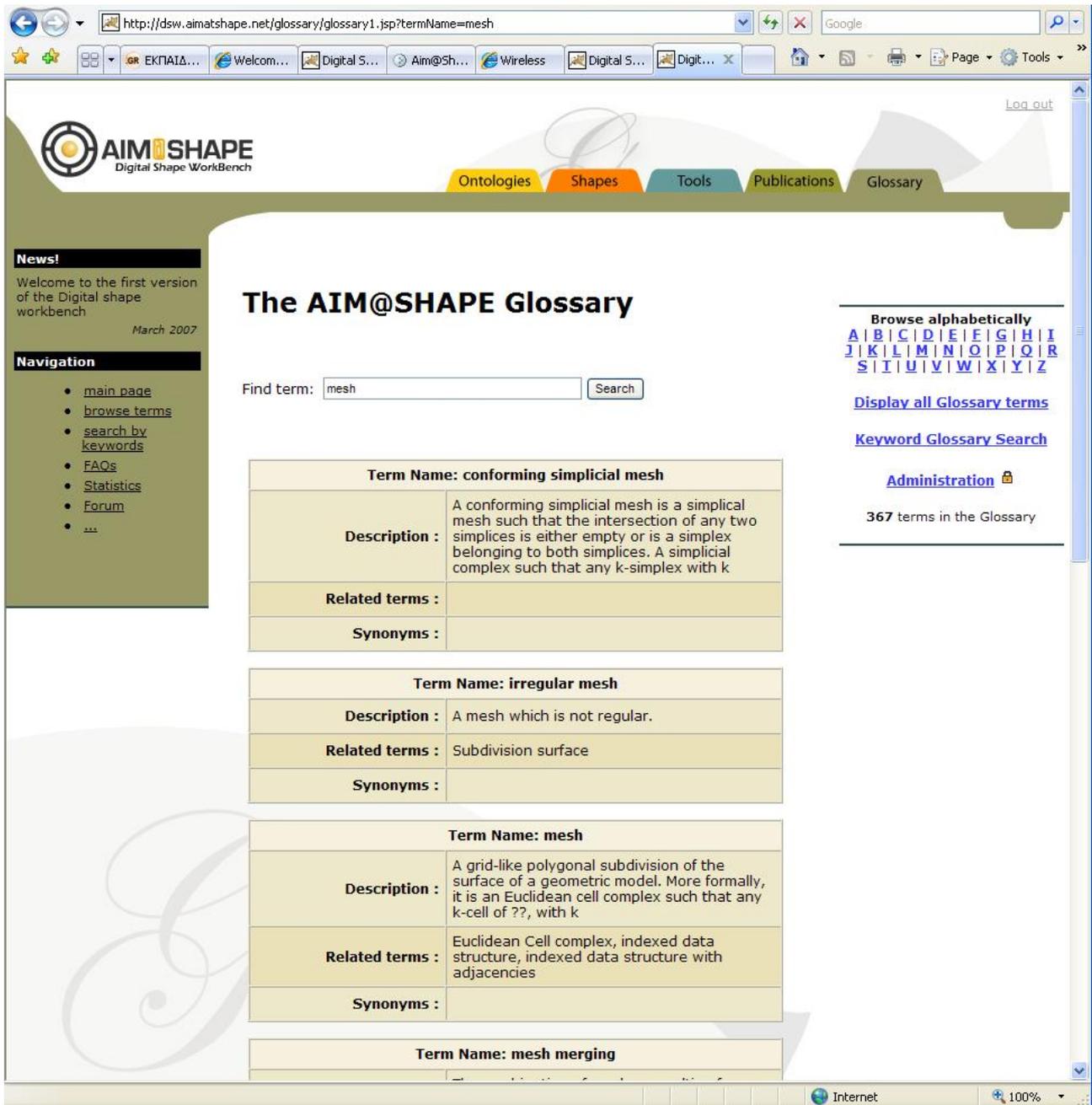[2] http://www.webchoir.com/

Figure 1. The Glossary home page.

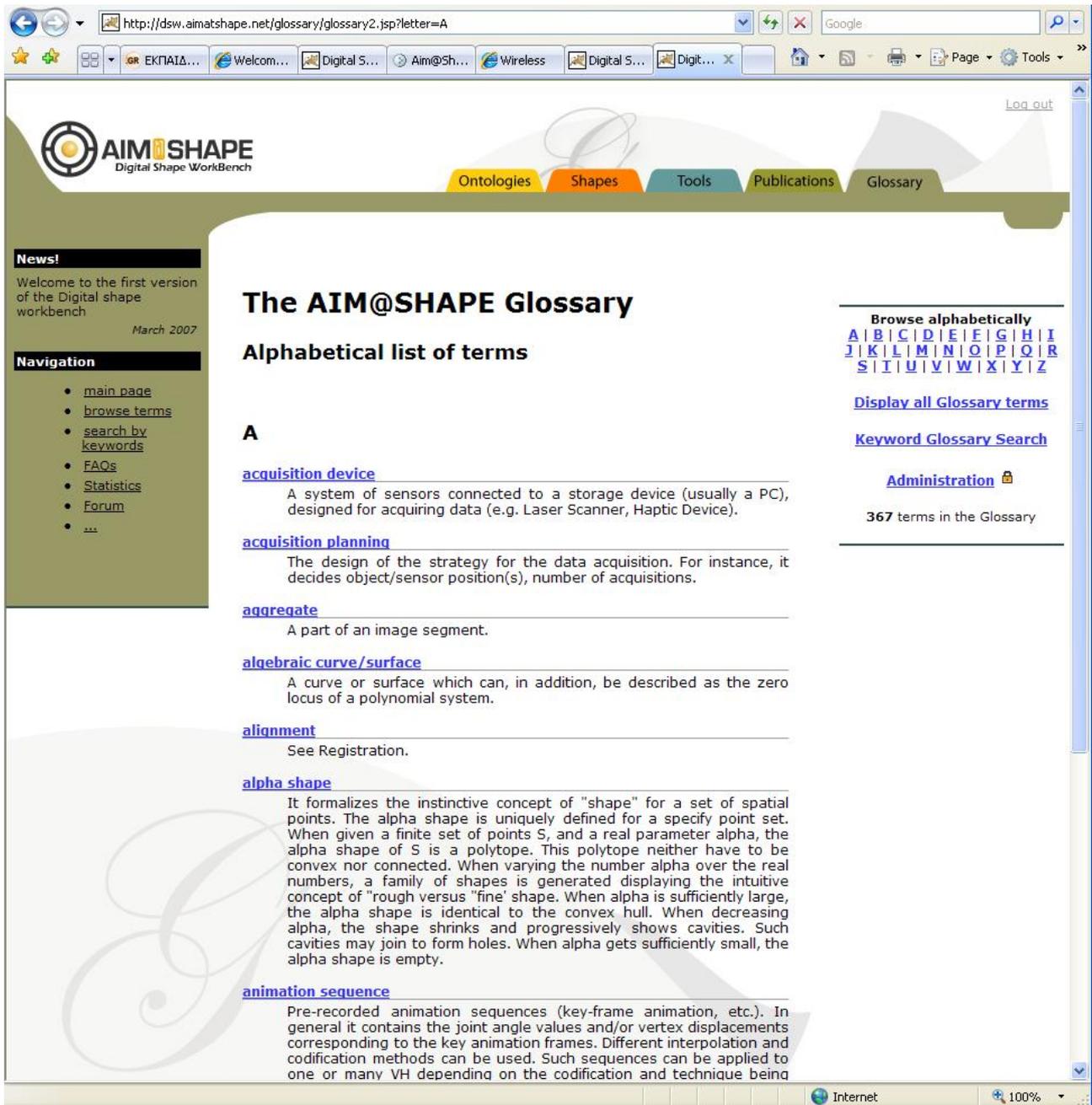Figure 2. Keyword search of a glossary term.

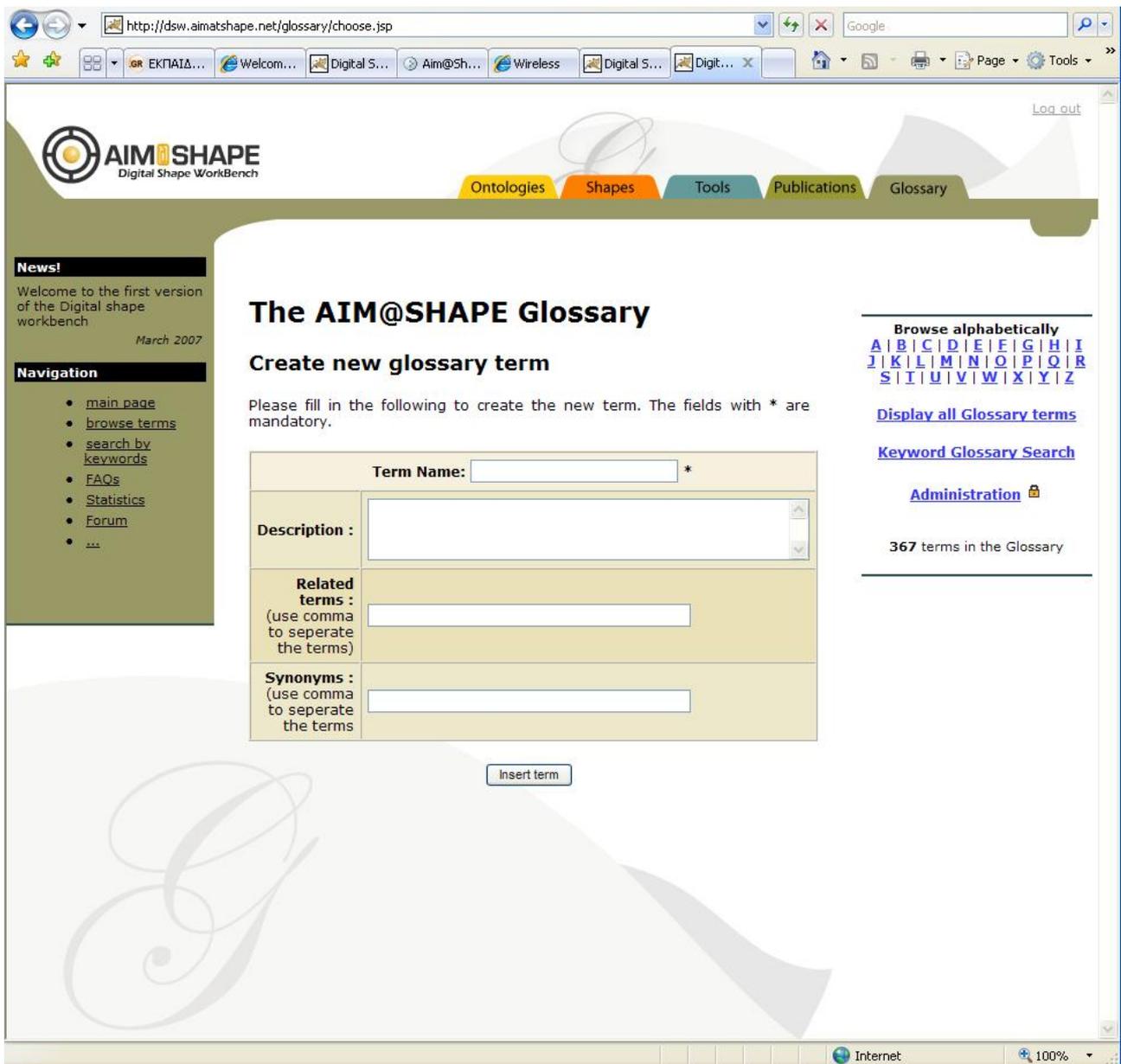Figure 3. Browsing the glossary terms alphabetically.

Figure 4. New term insertion form.

APPENDIX A - GLOSSARY OF TERMS

Acquisition Device
A system of sensors connected to a storage device (usually a PC), designed for acquiring data.
Synonyms:
Relater terms: stereo vision

Acquisition Planning
The design of the strategy for the data acquisition. For instance, it decides object/sensor position(s), number of acquisitions.
Synonyms:
Relater terms: Acquisition Device, stereo vision

Aggregate
A part of an image segment.
Synonyms:
Relater terms: segment, segmentation, image segmentation, object segment

Algebraic curve/surface
A curve or surface which can, in addition, be described as the zero locus of a polynomial system.
Synonyms:
Related terms: Implicitisation, Implicit Curve/Surface

Alignment
See Registration.
Synonyms: registration
Relater terms: ICP, PCA, matching

Alpha shape
It formalizes the instinctive concept of "shape'' for a set of spatial points. The alpha shape is uniquely defined for a specify point set.
When given a finite set of points S, and a real parameter alpha, the alpha shape of S is a polytope. This polytope neither have to be convex nor connected. When varying the number alpha over the real numbers, a family of shapes is generated displaying the intuitive concept of "rough versus "fine'' shape. When alpha is sufficiently large, the alpha shape is identical to the convex hull. When decreasing alpha, the shape shrinks and progressively shows cavities. Such cavities may join to form holes. When alpha gets sufficiently small, the alpha shape is empty.

Animation Controller
Algorithms used to produce animations. The class specifies the inputs required for the algorithm to work and the outputs (usually animation sequences or specific joint values) it is capable to produce.
Synonyms:
Related terms: Virtual Human, Behavioral Animation, Animation Sequence

Animation Sequence
Pre-recorded animation sequences (key-frame animation, etc.). In general it contains the joint angle values and/or vertex displacements corresponding to the key animation frames. Different interpolation and codification methods can be used. Such sequences can be applied to one or many VH depending on the codification and technique being used.
Synonyms:
Related terms: Virtual Human, Motion Capture, Key frame Animation

Approximation
The process of generating a function, a curve, or surface, that is close to given spatial constraints (typically point samples).
Synonyms:

Related terms: Compression, Continuous Levels-of-detail (LOD) Model, Hierarchical B-spline (H-Spline), multigrid algorithms, Multiresolution, Discrete Levels-of-detail (LOD) Model, Wavelet

Articulated character
3D animation object made of a geometric skin attached to an articulated skeleton. An articulated character animation is driven by skeleton animation and performed with Skeleton driven deformation.
Synonyms:
Related terms: Skeleton, Articulation, Joint, Virtual Human.

Articulated skeleton
See Control skeleton.
Synonyms: Skeleton
Related terms: Joint, Articulation

Articulation
See skeleton joint.
Synonyms: Skeleton Joint, Joint
Related terms: Skeleton

Asymptotic curve
The asymptotic curve on a surface is that along which the normal curvature vanishes.

Behavioural Animation
Methods for animating characters by specifying their behaviour. For Virtual Humans behavioural animation is expected to exhibit an autonomous believable anthropomorphic behaviour, where Virtual Humans perform specific actions under pre-specified conditions.
Synonyms:
Related terms: Virtual Human, Animation Controller, Animation Sequence, Individual Descriptor

Blending
Surface connecting smoothly two 3D curves, with prescribed tangent planes along these curves.

Blending Graph
It is used for skeleton-based (or structural) implicit modelling. The vertices of this graph are the skeleton primitives. Two primitives are connected by an edge if they can blend their field contributions. The field at a space point P is then computed as the sum of the field from the primitive that contributes the most at P and the contributions from all its neighbouring primitives in the graph. The use of such a graph prevents unwanted blending.

Body animation
Methods for animating the body of a Virtual Human. Body animation is usually performed with Skeleton Driven Deformations.
Synonyms: Animation Controller
Related terms: Virtual Human, Animation Sequence, Motion Capture, Key frame Animation, Skinning

Body pose
See. Body posture.
Synonyms: Body Posture
Related terms: Virtual Human, Animation Controller, Forward Kinematics, Inverse Kinematics, forward Dynamics, Inverse Dynamics

Body posture
Specification of joint values describing a virtual human body posture. A body posture can be defined using forward/inverse kinematics, forward/inverse dynamics or even motion capture.
Synonyms: Body pose
Related terms: Virtual Human, Animation Controller, Forward Kinematics, Inverse Kinematics, Forward Dynamics, Inverse Dynamics

Boundary conditions
In a physical model simulation, they describe the physical conditions at the boundaries of the simulation region.
Synonyms:
Related terms: Finite Element Method

Boundary Representation (B-Rep)
Geometric representation of objects defined in terms of the faces, edges and vertices which make up its boundary. The boundary of a three dimensional solid is a two dimensional surface, that is usually represented as a collection of faces. Usually, the segmentation of the surface into faces is performed so that the shape of each face has a compact mathematical representation, e.g. that the face lies on a single geometric surface. Faces, again, are often represented in terms of their boundary being a one-dimensional curve. Hence boundary models may be viewed as a hierarchy of models.
Synonyms: B-Rep

Related terms: CAD, Winged-edge data structure

Bounding Box
The minimal closed volume that completely contains the object
Synonyms:
Related terms:

Brand Identity
The set of features, attributes, benefits, performance, quality, service support, and the values that a brand possesses. The brand can be viewed as a product, a personality, a set of values, and a position it occupies in people's (customers') minds. Brand identity is everything the company wants the brand to be seen as.
Synonyms:
Related terms: Styling process, character line, conceptual design

B-Rep
See Boundary Representation.
Synonyms: Boundary Representation
Related terms: CAD, Winged-edge data structure

B-Spline curve/surface
General form of piecewise rational or polynomial parametric curve/surface, which is represented by control points, basis functions, and possibly, weighs.
Synonyms:
Related terms: Free-form surface

Butterfly scheme
An interpolating subdivision scheme for triangle meshes.
Synonyms:
Related terms: Subdivision Surface

CAD
See Computer Aided Design.
Synonyms: Computer Aided Design
Related terms: B-rep, Boundary Representation, Product Modelling

Calibration
Measuring the parameters appearing in the equations ruling the acquisition process of an acquisition device.
Related terms: Acquisition device, Registration

Camera
A lightproof box fitted with a lens though which the image of an object is recorded on a material sensitive to light.
Related terms: Acquisition Device

CAS
See Computer Aided Styling.
Synonyms: Computer Aided Styling
Related terms: Industrial Design,Styling process

Case Based Reasoning (CBR)
The process of solving new problems based on the solutions of similar past problems. CBR starts with a set of cases or training examples; it forms generalizations of these examples, albeit implicit ones, by identifying commonalities between a retrieved case and the target problem.

Catchment Basin
The catchment basin of a minimum m on a surface described by a C^2-differentiable function defined over a domain D in R^2 is the locus of the points in D which are closer to m than to any other minimum according to the topographic distance.

Catmull-Clark scheme
A subdivision scheme for quad meshes generalizing the bivariate cubic spline.
Synonyms:

Related terms: Subdivision Surface

CBR
See Case Based Reasoning.

Center-line
See center-line skeleton.
Synonyms: Center-line skeleton
Related terms: Skeleton, Medial axis, Shock graph, Straight-line skeleton, Skeletal linear structure

Center-line skeleton

The concept of center-line is strictly related to that of skeleton. Complex objects can be seen as the arrangement of tubular-like components, and abstracted to a collection of center-lines which split and join, following the object topology, and which form, actually, a skeleton. A center-line should satisfy the following requirements: centricity, connectivity and singularity.
Synonyms:
Related terms: Skeleton, center-line

Characteristic map
An 1-1 local map between the subdivision surface around an extraordinary vertex and the tangent plane at that vertex. The existence of the characteristic map guarantees C^1 continuity of the subdivision surface at that vertex.
Synonyms:
Related terms: Subdivision surface

Character line
Basic drawing lines needed to define or characterize an object in the styling phase. They are used to give specific impression/feeling when looking at the object (e.g. the object appears sweet/aggressive), or to define a common peculiar aspect among set of products, as a signature of the designer (e.g. Pininfarina vs. Giugiaro) or the construction company (e.g. Alfa Romeo vs. Peugeot). Most of the character lines are virtual (i.e. only perceived) lines, such as light or curvature lines.
Synonyms:
Related terms: Brand Identity, Styling process, feature, structural feature, detail feature

Clay Modelling
Modelling with clay to produce (scaled or full size) physical models of a product for evaluation purposes. Different material can be used to create the physical prototypes, but clay is especially used in the automotive industry.
Synonyms:
Related terms: Product Modelling, Product Development Process

Clustering
A process of dividing elements in a dataset into subgroups, by determining which of these elements are similar.
Synonyms:
Relater terms: segmentation, aggregate, object segment, image segmentation

Colour mapping
A colour-coded map is an application which associates to a scalar function value a specific colour by using a colour table.

Compression
Compression aims at storing a data set in a more compact way than the original data file. Two main approaches for data compression exist:
- *Reversible* compression, where different packing and re-indexing techniques are use to represent the data with the fewest possible number of bytes without loosing information.
- *Non-reversible* compression, techniques where information is lost and tolerances and other parameters describe which information is allowed to be lost.

Which compression techniques to use depend to a large extent of the later use of the information. Information that is only to be used for visual purposes often allow for high compression rates as the human eye most often do not detect small errors without a detailed scrutiny of the image. Information to be used in downstream computations can be degraded

by compression, as compression algorithms tends to insert false structure in a data set, e.g., thinning a polyline description of a circle, will make the circle resemble a rough polygon.

Synonyms:
Related terms: Approximation, , Continuous Levels-of-detail (LOD) Model, Hierarchical B-spline (H-Spline), multigrid algorithms, Multiresolution, Discrete Levels-of-detail (LOD) Model, Wavelet

Computational fluid dynamics
The numerical simulation of fluid flows, such as the flow of air around a moving car or plane.
Synonyms:
Related terms: Boundary Conditions, FEM, Product modelling

Computational mechanics
Field of mechanics solving specific problems by simulation through numerical methods implemented on digital computers.
Synonyms:
Related terms: Boundary Conditions, FEM, Product modelling

Computer Aided Design (CAD)
2D or 3D design software package or visualisation able to assist the product development process.
Synonyms: CAD
Related terms: B-rep, Boundary Representation

Computer Aided Styling (CAS)
3D surface design and evaluation software suitable for an accurate definition of the shape and aesthetics of a product.
Synonyms:
Related terms: CAS, Industrial Design

Computer Tomography Scan Device
From the Greek words "to cut or section" (tomos) and "to write" (graphein), it is a method of separating interference from the area of interest by imaging cut sections of the object. Its main application is medicine (see DICOM as standard output shape)
Synonyms: CT Scan Device

Conceptual design
Starting phase of the product development in which designers clarify the requirements for a product and define its functions, structure, shape, materials, interfaces, behaviour and appearance.
Synonyms:
Related terms: Styling process, Product Development Process

Concurrent Engineering
Management/operational approach which aims at improving product design, production, operation, and maintenance by developing environments in which personnel from all disciplines (design, marketing, production engineering, process planning, and support) work together and share data throughout all phases of the product life cycle.
Synonyms:
Related terms: CAD, Product development process, Distributed design

Conforming simplicial mesh

A conforming simplicial mesh is a simplicial mesh such that the intersection of any two simplices is either empty or is a simplex belonging to both simplices. A simplicial complex such that any *k*-simplex with *k*<*d*, bounds at least one *d*-simplex in the complex is a conforming simplicial mesh.
Synonyms:
Related terms: Mesh, FEM

Conformity set up
Set of operators generating a conform model through healing treatments.
Synonyms:
Related terms: CAD, FEM

Connected component
Part of an object such that the path between any two points in that part lies within the same part.

Constraint
In geometric modelling, geometric condition that the model has to respect; for example, it can be a point, tangency or curvature constraint. More generally, any condition that a model has to respect according to some specific application purposes (from geometry, aesthetics, manufacturing, and so on).
Synonyms:
Relater terms: model composition

Constructive Solid Geometry
Geometric representation in which the model is defined as combinations of primitive sets by Boolean operators (union, intersection, subtraction).
Synonyms:
Relater terms: CAD, model composition

Continuous Levels-of-detail (LOD) Model
Both progressive and variable-resolution LOD model are continuous models. Often, in the literature, the term continuous LOD models is used to indicate only variable- resolution LOD models.
Synonyms:

Related terms: Approximation, Compression, Continuous Levels-of-detail (LOD) Model, Hierarchical B-spline (H-Spline), multigrid algorithms, Multiresolution, Discrete Levels-of-detail (LOD) Model, Wavelet, subdivision surfaces

Continuum mechanics
Branch of computational mechanics studying bodies at the macroscopic level, using continuum models in which the microstructure is homogenized by phenomenological averages.
Synonyms:

Related terms: FEM

Contour
(1) One or a set of curves originated through intersection of a plane with the object.
 See iso-levelSynonyms: iso-level
Related terms: Curve-surface intersection, Ray-surface intersection,
Self-intersection, Subdivision, structural feature, level set

Contour set
Anintersection curve between the surface and a family of parallel planes.
Synonyms:
Related terms: Contour, Curve-surface intersection, Ray-surface intersection,
Self-intersection, Subdivision, level set

Contour tree
The contour tree of a scalar field is the graph obtained by continuous contraction of each contour of (D, h) to a single point. It represents the relations between the connected components of the level sets of a scalar fields. Contour trees are special cases of the Reeb graphs.
Synonyms:
Related terms: Reeb Graph

Control Point
A point on a curve or surface that influence the shape in a region of the curve or surface. Control points are most frequently used for modelling of Bezier, B-spline and NURBS curves and surfaces, but the concept is not restricted to these. Sometimes control points are on the curve or surface they belong to, often control points are close to the curve or surface, but not close to the surface and influence the shape close to the point.
Synonyms:
Related terms: B-Spline curve/surface, NURBS

Control skeleton
A connected set of segments, corresponding to limbs, and joints, corresponding to articulations.
Synonym:
Related term: Skeleton, Joint, Articulation, Segment

Convolution surface
It calculates the field value at P as the integral of the field contributions from each point of the skeleton. This results into smooth, bulge-free, surfaces for skeletons defined as graphs of branching curve and surfaces pieces.

Critical point
A point p in R^2 is a critical point of a C^2-differentiable function defined over a domain D in R^2 if and only if the gradient of f vanishes at p.
Synonyms:
Related terms: Reeb graph, Index of a critical point

Critical Point Configuration Graph (CPCG)
It is defined for a Morse function f defined on the closure of a simply-connected open set in R^2. It is a graph G in which the nodes represent the critical points of f and two nodes in G are connected by an arc in G if there exists an integral line that emanates from one critical point (node) and reaches the other.
Synonyms:
Related terms: Surface network, Reeb graph

CSG
See Constructive Solid Geometry.

CT Scan Device
See Computer Tomography Scan Device.
Related terms: Computer Tomography Scan Device

Culling
A concept from computer graphics used for the methods employed to sort not visible geometry sent to the graphics pipeline to avoid using computational resources on invisible parts of the objects displayed. Culling can both be performed on the CPU and by the graphics card.

Curvature
Let C be a curve and let P be a point on C. Let N be the normal at P and let O be the point on N which is the limit of where the normal to C at P' intersects N as P' tends to P. O is the *centre of curvature* at P and PO is the *radius of curvature* at that point.
Synonyms:
Related terms: Curvature, Focal Surface, Gaussian curvature, Generalised Focal Surface, Hedgehog Diagram, Inflection Point, Line of curvature, Mean curvature, Principal curvatures, Umbilical point

Curve-curve intersection
Points of coincidence of two curves. The points lie on both curves, and thus, it is a way to compute points on a curve.

Synonyms:
Related terms: Contour, Curve-curve intersection, Curve-surface intersection, Ray-surface intersection, Self-intersection, Subdivision, Surface-surface intersection

Curve-surface intersection
Points of coincidence of a space curve and a surface. The points lie on both, the surface and the space curve, and thus, it is a way to compute points on a surface.
Synonyms:
Related terms: Contour, Curve-surface intersection, Ray-surface intersection, Self-intersection, Subdivision

Decimation
Reduction of the number of triangles in a triangle mesh, maintaining the original topology of the mesh and preserving a good approximation to the original geometry.
Synonyms: simplification
Related terms:

Decision trees
A family of classification algorithms. The algorithm classifies data by hierarchical decomposition of conditions, which can be learned from a labeled set of training data.
Synonyms:
Relater terms: Support Vector Machines, clustering

Defocus/focus (shape from)
Estimating the 3D surface of a scene from a set of two or more images of that scene. The images are obtained by changing the camera parameters (typically the focal setting or the image plane axial position), and taken from the same point of view.
Related terms: Camera, Acquisition Device

Degrees of freedom
(1) The variables one can employ in manipulating geometry. Typically, these are the vertices of polygonal meshes and the control points and knots, in case of B-splines.
(2) A particular axis of rotation within a skeleton joint.

Design for X

Philosophy suggesting that a design can be continually reviewed from the start to the end to find ways to guide the design process and improve production and other non-functional aspects. "Design for manufacture" and "design for assembly" methodologies remain the most important as they have a direct and recognisable impact on product costs.
Synonyms:
Related terms: Product Development Process

Detail feature
Aesthetic features of the shape. In accordance with the stylists' activity, they are created in the second modelling phase and applied on a surface for adding aesthetic and functional details and for enforcing the visual effects of important shape elements. Detail features can be classified according to the type of action performed on the surface, i.e. an area deformation or elimination (*modelling classification*), to the position of the influence area (*topological classification*), and to the morphological aspects of the resulting shape, i.e. the image of the deformed part (*morphological sub-classification*).
Synonyms:
Related terms: character line, styling process, conceptual design, structural feature, feature

DICOM
Digital Imaging and Communications in Medicine. A comprehensive set of standards for handling, storing and transmitting information in medical imaging. It includes a file format definition and a network communication protocol.
Synonyms:
Related terms: Range Image

Digital Terrain Model (DTM)
A discrete model of a topographic surface built on the basis of a finite set of points sampled on the surface itself.
Synonyms:
Related terms: Terrain, Topographic surface

Direct kinematics
See Forward kinematics.
Synonyms: Forward kinematics
Related terms: Animation Controller, Inverse kinematics, Body Posture.

Direct Manipulation
A method that offers direct manipulation of geometry, typically in the context of multiresolution editing of freeform curves and surfaces, and possibly with constraints.
Synonyms:
Related terms: Free-form surface, constraint

Discrete Levels-of-detail (LOD) Model
A collection of independent shape representations, each at a different level of detail.
Synonyms:
Related terms: Approximation, Compression, Continuous Levels-of-detail (LOD) Model, Hierarchical B-spline (H-Spline), multigrid algorithms, Multiresolution, Discrete Levels-of-detail (LOD) Model, Wavelet

Discretisation
In FE problems, conversion of a geometric model into a suitable discrete model with a finite number of degrees of freedom.

Distance surface
It calculates the field value at a point P as a decreasing function of the distance between P and the closest point on the skeleton.
Synonyms:
Related terms: Skeleton, Medial Axis

Distributed design
Product design performed by actors but located in different places (even in the same company), working on different aspect of a product, but sharing its data.
Synonyms:
Related terms: Concurrent engineering

Doo-Sabin scheme
A subdivision scheme for quadrilateral meshes generalizing the bivariate quadratic spline.
Synonyms:
Related terms: Subdivision surface

DTM
See Digital Terrain Modeling.
Synonyms: Digital Terrain Modeling
Related terms: Terrain, Topographic surface

Edge collapse
It consists of contracting an edge e in a simplicial mesh to a vertex v, which can either be a new vertex (*full-edge collapse*) or one of its extreme vertices *(half-edge collapse).* In a triangle mesh, the simplices incident at e become simplices of one dimension lower. All simplices incident in one of the two extreme vertices of e become incident at v.
Synonyms:
Related terms: Boundary Representation, B-rep, Edge collapse, Simplicial mesh, Vertex insertion, Vertex removal, Vertex split, Winged-edge data structure, simplification, decimation

End-effector
The free extremity of an end segment in a control skeleton.
Synonyms:
Related Terms: Inverse Kinematics, Animation Controller

Equi-brightness curve
The equi-brightness curve of a surface is the locus of points where the brightness of an illuminated surface is constant.

Equi-gradient curve
The equi-gradient curve of a surface is formed by the points where the angle between the surface normal and a given vector is constant.

Euclidean Cell complex
Let Γ be a connected finite set of cells of heterogeneous dimensions embedded in the Euclidean space R^n and d the ith maximum of the dimensions of the cells of Γ, such that the boundary of each cell in Γ is a collection of cells of lower dimensions belonging to Γ. Then, Γ is a *d-dimensional cell complex* if and only if the interiors of any pair of d-dimensional cells of Γ are disjoint.

Extraordinary vertex
A non-regular vertex.
Synonyms: irregular vertex
Related terms: Subdivision surface, Regular vertex

Facial animation
Methods for animating the face of a Virtual Human. Facial animation is usually performed with Skin Interpolation.
Synonyms:
Related terms: Virtual Human, Animation Sequence, Animation Controller, Skinning

Fairing
Before computers the smooth curves describing the hulls of ships were faired by using an elastic thin wood ruler, the spline. Today the word *fairing* relates to designing and editing smooth curves and surface within CAD-type systems.
Synonyms:
Related terms: CAD, free-form surface

Feature
Very general term indicating any characteristic of a phenomenon or of an object, for example a surface patch of certain curvature characteristics. In CAD, it refers to a set of geometric elements with a special meaning and controllable by means of a limited number of significant parameters. The meaning depends on the context: for example, it can be related to functionality, geometry, assembly and manufacturing.
Synonyms:
Related terms: Curvature, Product modelling

FE Element
Each parts in which the geometry is subdivided by a finite element mesh. For 2D analysis, or a 3D thin shell analysis, the elements are essentially 2D. For a 3D solid analysis, the elements have physical thickness in all three dimensions. (examples: solid linear brick , solid parabolic tetrahedral elements…).
Synonyms:
Related terms: FEM, Simulation process

FEM
See Finite Element Method.
Synonyms: Finite Element Method
Related terms: FE element, Simulation process

Fillet
Surface joining and smoothing two other surfaces, defined as the envelope of spheres rolling along the intersection curve of these two surfaces.
Synonyms:
Related terms: CAD

Finite Element Method (FEM)
Numerical method able to solve a wide variety of mechanical problems (structural, mechanical, heat transfer, fluid dynamics, …) through the discretization of the model in the 3D space.
Synonyms: FEM
Related terms: FE element, simulation process

Flexion
Rotation of the limb which is influenced by the joint and causes the motion of all limbs linked to this joint. This flexion is carried out relative to the joint point and a flexion axis has to be defined.
Synonyms:
Related terms: Joint, Skeletal animation, Skeleton Joint angle

Focal Surface

The focal surface is formed by the centres of curvature of a given smooth surface. Thus, the focal surface consists of two sheets corresponding to the maximal and minimal principal curvatures.
Synonyms:
Related terms: Curvature, Focal Surface, Gaussian curvature, Generalised Focal Surface, Hedgehog Diagram, Inflection Point, Line of curvature, Mean curvature, Principal curvatures, Umbilical point

Form Feature
In CAD, it is a geometric feature composed by parts of analytic surfaces (planes, cylinders and spheres).
Synonyms:
Related terms: Feature, Free-form feature, Product Modelling

Forward dynamics
In forward dynamics, a skeletal motion is determined from input torques and forces.
Synonyms:
Related terms: Inverse dynamics, Animation Controller, Body Posture

Forward kinematics
In forward kinematics, a skeletal posture is determined by assigning input joint angles individually for all the joints of a chain.
Synonyms: Direct Kinematics
Related terms: Inverse kinematics, Animation Controller, Body Posture

Fractal
A fractal is an object that exhibits self-similarity: the same form on all scales. A typical example is a snowflake. The boundary of the fractal object has a fractal (non-integer) dimension.
Synonyms:
Related terms: L-System

Free-form feature
In CAD, it is a geometric feature composed by free-form surfaces.
Synonyms:
Related terms: Feature, Form feature, Product Modelling

Free-form surface
Any 2 or 3 dimension shape that is not easily decomposable in regular or analytic shapes.
Synonyms:
Related terms: B-spline surface, NURBS

Fusion
The combination of data from different sources.

Gaussian curvature
An intrinsic property of a space independent of the coordinate system used to describe it, which equals the product of the principal curvatures.
Synonyms:
Related terms: Curvature, Focal Surface, Gaussian curvature, Generalised Focal Surface, Hedgehog Diagram, Inflection Point, Line of curvature, Mean curvature, Principal curvatures, Umbilical point

Generalised Focal Surface

The locus of all points of a normal congruence proportional to a curvature function value at these points. It is quite related to hedgehog diagram. Instead of drawing surface normals proportional to a function value, all the points on the surface normals proportional to the function value are drawn.

Synonyms:

Related terms: Curvature, Focal Surface, Gaussian curvature, Generalised Focal Surface, Hedgehog Diagram, Inflection Point, Line of curvature, Mean curvature, Principal curvatures, Umbilical point

Genus

A topologically invariant property of a surface defined as the largest number of non-intersecting simple closed curves that can be drawn on the surface without separating it. Roughly speaking, it is the number of holes in a surface.

Synonyms:

Related terms: Manifold

Geodesic path

It is a line which connect two points on a curved surface with minimum path length.

Geometric Continuity

Two C^k curves or surfaces join at a boundary with geometric continuity G^k if it is possible to a reparametrise both the curves or surfaces with a unique map such that the derivatives of the component functions agree. For $k=0$, it coincides with C^0, for $k=1$, it is a continuity of the tangent plane, for $k=2$, it is a continuity of curvature.

Synonyms:

Related terms: Parametric continuity

Gridded elevation model

A gridded elevation model is a DTM defined by a domain partition into a cell complex in which the 2-cells are squares.

Synonyms: Regular square grid

Related terms: DTM

Half-edge data structure

A data structure for encoding a mesh. For each edge of the mesh, the data structure stores two half-edges, and information about the edge is split between such two halves. Each half-edge stores the index of its origin, the index of the face on its left, two indices of its previous and next edges along the boundary of that face, and the index of its twin half-edge, which is oriented in the opposite direction. Information attached to vertices and faces are the same as in the winged-edge and in the DCEL data structures.

Synonyms:

Related terms: Mesh

Hand Posture

Specification of joint values describing the hand posture required to grab or manipulate a Smart Object.

Synonyms:

Related terms: Smart Object, Body Posture.

H-Anim Skeleton

The H-Anim skeleton is an animation-oriented structural descriptor. It is an efficient representation of an articulated skeleton for Virtual Humans. It was initially proposed by the Humanoid Animation Working Group (http://www.h-anim.org). Now it has been adopted by

the MPEG-4 specification as one of the standard structural descriptors for animatable Humanoid Virtual Characters.
Synonyms:
Related terms: Virtual Human, Skeleton, Node, Joint, Segment, Site

Haptic Device
A device which allows a user to interact with a computer by receiving tactile feed back. This feedback is achieved by applying a degree of opposing force to the user along the x, y, and z axes. There are two main types of haptic devices: glove or pen-type devices that allow the user to "touch" and manipulate 3-dimensional virtual objects and devices that allow users to "feel" textures of 2-dimensional objects with a pen or mouse-type interface
Related terms: Acquisition Device

Healing
Technology to detect and repair connectivity problems (e.g. gaps) in order to have a conform geometric model.
Synonyms:
Related terms: CAD, Product Modelling, Repairing

Hedgehog Diagram
A hedgehog diagram (curvature profile) for planar curves visualizes the curve normals proportional to the curvature value at some curve points.
Synonyms:
Related terms: Curvature, Focal Surface, Gaussian curvature, Generalised Focal Surface, Hedgehog Diagram, Inflection Point, Line of curvature, Mean curvature, Principal curvatures, Umbilical point

Hierarchical B-spline (H-Spline)
A scheme of defining surfaces using overlays of B-spline surfaces. A complex surface is defined as a single tensor product square patch with other tensor product patches laid on top of it at different orientations and sizes.
Synonyms:

Related terms: Approximation, Compression, Continuous Levels-of-detail (LOD) Model, multigrid algorithms, Multiresolution, Discrete Levels-of-detail (LOD) Model, Wavelet, B-Spline

Hierarchical Model
Organisation of data records as a collection of trees, rather than arbitrary graphs. With respect to geometry a rough description of the geometry is located at the highest level, and more and more details are added descending the tree.
Synonyms:
Related terms: Multiresolution, LOD

Highlight line
A highlight line is defined as the locus of all points on a surface where the orthogonal distance between the surface normal and the light line is zero.

Homotopy type
A class formed by sets in the Euclidean space which have essentially the same structure, regardless of size, shape and dimension. The essential structure is what a set keeps when it is transformed by compressing or dilating its parts, but without cutting or gluing.
Synonyms:

Related terms: Manifold, Simplicial complex

Human joint
Joint node, basic building block of a Virtual Human skeleton, representing the actual joints on a human being: shoulders, wrists, vertebrae, etc. A joint can have different kinds of children: they can be segments (typically used to store the actual geometry of each limb), or other joints. Under certain cases (not H-Anim 1.0 compliant) a joint could directly store a geometry node.
Synonyms:
Related terms: Virtual Human, Skeleton, Joint

Human segment
Node specialisation for H-Anim Segments, typically used as the container of a 3D shape representing a given human body part.
Synonyms: Segment
Related terms: Skeleton, Virtual Human

Image
A 2- or larger dimensional array of measurements. In common usage, images refer to digital recordings of intensities obtained with a camera.
Synonyms:
Relater terms: pixel, Magnetic Resonance Imaging

Image Segmentation
A division of an image into a collection of (usually non-overlapping) segments.
Synonyms: segmentation
Relater terms: clustering, aggregate, object segment, segment, segmentation

Implicitisation
A process which consists in the conversion of a parameterised representation of an algebraic curve or surface into an implicit representation.
Synonyms:
Related terms: Algebraic curve/surface, Implicit Curve/Surface

Implicit LOD representation
It refers to any implicit representation that provides different levels of detail for the implicit surface.
Synonyms:

Related terms: Implicit Curve/Surface, LOD

Implicit Curve/Surface
The set of points P in space verifying an implicit equation (f(P) – *constant* = 0). f is called the "field function" (and sometimes the "implicit function", which is improper since this function is explicitly given by its parametric equation).
Synonyms:
Related terms: Algebraic curve/surface, Implicitisation, Implicit LOD representation

Impostor
An impostor is an image that represents a part of a complex object, and it is usually generated by capturing a rendered image of this object from the predefined camera position. It is mapped on the polygon that is best suited for the specific camera position.

Index of a critical point

Number of negative eigenvalues of the Hessian matrix of a C^2-differentiable function defined over a domain D in R^2.
Synonyms:

Related terms: Critical point

Indexed data structure
A data structure for triangle and tetrahedral meshes. For each triangle (tetrahedron) in the mesh, the indices to its three (four) vertices are encoded.
Synonyms:
Related terms: Mesh

Indexed data structure with adjacencies
Extension of the indexed data structure for both triangle and tetrahedral meshes. It encodes, for each triangle (tetrahedron) t, also the indices to the three triangles (four tetrahedra) edge-adjacent (face-adjacent) to t.
Synonyms:
Related terms: Mesh

Individual Descriptor
Human like traits that can be used to describe virtual human characters; these traits can be personality models, emotion, mood, etc. These descriptors are considered to create behavioural animations.
Synonyms: Individuality
Related terms: Virtual Human, Behavioural Animation

Individuality
See Individual Descriptor.
Synonyms: Individual Descriptor
Related terms: Virtual Human, Behavioural Animation

Industrial Design
The professional service of creating and developing concepts and specifications that optimise the function, value, and appearance of products and systems for the mutual benefit of both user and manufacturer.
Synonyms:
Related terms: CAS, Computer Aided Styling, Styling process, Brand Identity

Inflection Point
A point on a curve at which the curvature changes sign, passing from concave to convex or vice versa.
Synonyms:
Related terms: Curvature, Focal Surface, Gaussian curvature, Generalised Focal Surface, Hedgehog Diagram, Inflection Point, Line of curvature, Mean curvature, Principal curvatures, Umbilical point

Influence Area
It usually refers to the area affected by applying a geometric operation to a surface (e.g. performing a modification).
Synonyms:
Related terms: Shape deformation

Integral line
An integral line of a function f is a maximal path which is everywhere tangent to the gradient vector field of f. An integral line is emanating from a critical point or from the boundary of D, and it reaches another critical point or the boundary of the domain D.
Synonyms:

Related terms: Separatrix line, Stable/unstable manifold of a critical point

Inverse dynamics
It consists in determining the forces and torques required to produce a prescribed motion.
Synonyms:
Related terms: Forward dynamics, Animation Controller, Body Posture

Inverse kinematics
In inverse kinematics, a skeletal posture is defined by specifying target location to end-effectors. The joint angles of the control skeleton are defined so that the end-effectors reach their targets as close as possible.
Synonyms:
Related terms: Forward kinematics, Animation Controller, Body Posture

Irregular mesh
A mesh which is not regular.
Synonyms:
Related terms: Subdivision surface

Irregular vertex
See extraordinary vertex.
Synonyms: irregular vertex
Related terms: Subdivision surface, Regular vertex

Iso-level
Synonyms: contour, isoline
Related terms: level set, contour set

Isoline
It is a surface curve along which some function defined over the surface has a constant value.
Synonyms: contour, iso-level
Related terms: level set, contour set

Iterative Closest Point (ICP)
Class of algorithms for alignment of meshes or point clouds. They are based on the assumption that closest points correspond to each other. Iteratively, for closest points the best transformation is computed and applied to the data set.
Synonyms:
Relater terms: alignment, registration, matching

Joint
A point of articulation between two or more bones, especially such a connection that allows motion.
Synonyms: Articulation
Related terms: Skeleton, H-Anim, Skeleton Joint

Joint limits
Maximum and minimum values that restrict the angle range of a joint.
Synonyms:
Related terms: Joint, Skeleton joint angle

K-dimensional Euclidean cell
A k-dimensional cell, or *k-cell* is a subset of the *n*-dimensional Euclidean space R^n homeomorphic to a closed *k*-dimensional ball, where $k \leq n$.

Synonyms:

Related terms: Simplicial complex, Mesh

Key-frame Animation
Type of animation that is defined by a set of frames, where each frame contains a set of key frames which indicate the position and orientation of defined objects in the animation. Each key frame includes a key time which orders the set of key frames.
Synonyms:
Related terms: Animation Sequence, Motion Capture

Landmark
A place holder to store information associated to a particular location on a 3D geometry. Landmarks can be anatomical structures used as a point of origin to locating other anatomical structures, or points from which measurements can be taken.
Synonyms: Site
Related terms: Segment

Laser Scanner
Device that emits highly amplified and coherent radiation of one or more discrete frequencies (e.g. a Linear Camera).
Synonyms:
Related terms: Acquisition Device

Level of Articulation
Term used in the H-Anim standard related to the degrees of freedom of a skeleton chain. LOA is also used relatively to LOD, with respect to multi-resolution for bone-based animation.
Synonyms: LOA
Related terms: Level of Detail, LOD

Level set (of a real function f)
The level set of a real function f is the pre-image through f of a constant value t in the domain of f. The level sets are also called contours or iso-levels. Level sets may be non-connected.
Synonyms: contour set
Related terms: contour, iso-level, isoline

Level of Detail
It is a compact description of several representations of a shape, from which representations of a shape at different levels of resolution can be obtained.
Synonyms: LOD
Related terms: Compression, Approximation, Continuous Levels-of-detail (LOD) Model, Hierarchical B-spline (H-Spline), multigrid algorithms, Multiresolution, Discrete Levels-of-detail (LOD) Model, Subdivision Surface, Level of Articulation

Linear axis
It is based on a linear wave-front propagation like the straight skeleton, but the discrepancy in the speed of the points in the propagating wave-front, though never zero, can decrease as much as wanted.
Synonyms:

Related terms: Skeleton, Straight-line skeleton, center-line skeleton, Medial Axis

Linear static problem
Linear static analysis deals with continuum static problems in which the response is linear in the cause-and-effect sense.

Synonyms:
Related terms: simulation process, continuum mechanics, FEM

Line of curvature
A surface curve whose tangent directions coincide with those of the principle directions. The lines of curvature form an orthogonal net everywhere on the surface except the umbilical points where the principal directions are not defined.
Synonyms:
Related terms: Curvature, Focal Surface, Gaussian curvature, Generalised Focal Surface, Hedgehog Diagram, Inflection Point, Line of curvature, Mean curvature, Principal curvatures, Umbilical point

Line of Sight
The straight line between the observer and the target.

LOA
See Level of Articulation.
Synonyms: Level of Articulation
Related terms:

LOD
Synonyms: Level of Detail
Related terms: Approximation, Compression, Continuous Levels-of-detail (LOD) Model, Hierarchical B-spline (H-Spline), multigrid algorithms, Multiresolution, Discrete Levels-of-detail (LOD) Model, Wavelet, Subdivision surface, Level of Articulation

Loop scheme
A subdivision scheme for triangle meshes generalizing the three directional box spline.
Synonyms:
Related terms: Subdivision surface

L-system
Lindenmayer system. A string rewriting system which can be used to generate fractals with dimension between 1 and 2.
Synonyms:
Related terms: Fractal, L-system surface

L-system surface
A surface built within a L-system.
Synonyms:
Related terms: Fractal, L-system

Magnetic Resonance Imaging
Three-dimensional images produced by a non-invasive diagnostic procedure that uses magnetic field resonance. MRI is commonly used to obtain 3D pictures of internal body structures. In the case of dynamic MRI it is the acquisition of a sequence of MRI images to monitor temporal changes in tissue structure.
Synonyms:
Related terms: Image

Manifold
A (separable Hausdoff) *k*-dimensional topological space *M* in which each point has a neighbourhood which is homeomorphic either to the *k*-dimensional open ball, or to the half-ball.

Marching cubes
An algorithm that extracts an implicit surface represented by a 3D regular grid of data values. This grid is often referred to as a grid of voxels. The eight corners of a voxel give a total of alternative 256 different configurations for the corner status. By standard operations these can be group into 15 alternative configurations. Triangulations representing these 15 can be pre-computed, and thus efficiently used when tracing the implicit surface described by the grid of voxels.
Synonyms:
Related terms: Implicit surface, Mesh

Matching
Finding the correspondence between two shapes, or finding the transformation that yields a good alignment between two shapes.
Synonims:
Relater terms: alignment, ICP, shape indexing, shape classification, shape signature

Mask
The subdivision rule for calculating a new vertex on the refined mesh, usually described by diagrams. Several masks are required to describe a subdivision scheme, e.g. mask for new vertices corresponding to old vertices, edges, faces, or boundary vertices.
Synonyms:
Related terms: Subdivision surface

Mean curvature
Given the principal curvatures k_1 and k_2, $H = (k_1 + k_2)/2$ is called the mean curvature.
Synonyms:
Related terms: Curvature, Focal Surface, Gaussian curvature, Generalised Focal Surface, Hedgehog Diagram, Inflection Point, Line of curvature, Mean curvature, Principal curvatures, Umbilical point

Medial Axis
The medial axis of a bounded open subset X is the set of points that have at least two closest points in the complement of X.
Synonyms:
Related terms: skeleton, shock graph, linear axis, straight-line skeleton, distance surface

Mesh
A grid-like polygonal subdivision of the surface of a geometric model.
More formally, it is an Euclidean cell complex such that any *k*-cell of Γ, with *k<d*, bounds at least one *d*-cell of Γ.
Synonyms:
Related terms: Euclidean Cell complex, indexed data structure, indexed data structure with adjacencies, K-dimensional Euclidean cell

Mesh merging
The combination of meshes resulting from different viewing directions into a single mesh.
Synonyms:

Relater terms: model composition, ICP

Minkowski Sum
Set of point with integer coefficients that can be obtained as sum of two vectors with integer coefficients taken from two other sets of vectors with integer.
Synonyms:

Related terms: Wavelet

MOCAP
See Motion Capture.

Synonyms: Motion Capture

Related terms:

Model Composition
A process by which a new 3D model (e.g. a mesh) is constructed by the seamless composition of two or more existing models.
Synonyms:
Relater terms: Mesh merging, constraints

Morphology
See Morphological Descriptor
Synonyms: Morphological Descriptor
Related terms: Virtual Human

Morphological Descriptor
Describes the morphology of a human like: age, weight, height, gender, etc.
Synonyms: Morphology
Related terms: Virtual Human

Morphing
The process of making a smooth transition between two shapes.
Synonyms:
Related terms: morph target

Morph Target
It defines a different version of an object over time. A morph target is built by deforming/morphing a base shape of an object into a different shape that represents the same object in a different configuration. Morph targets can be used to animate 3D objects with skin interpolation.
Synonyms:
Related terms: morphing

Morse function
A C^2-differentiable function defined over a domain D in R^2 such all the critical points are non-degenerate.
Synonyms:

Related terms: Morse theory, critical point

Morse-Smale complex

The stable (unstable) manifolds are pair-wise disjoint and decompose the domain *D* of a Morse-Smale function *f* into open cells, whose closure form a complex, called a *Morse-Smale complex.*
Synonyms:
Related terms: Morse-Smale function, Morse theory, Stable/unstable manifold of a critical point

Morse-Smale function

A Morse function *f* is called a Morse-Smale function if and only if the stable and unstable manifolds intersect only transversally.
Synonyms:
Related terms: Morse-Smale complex, Morse theory, critical point

Morse theory

A generalisation of calculus of variations which draws the relationship between the stationary points of a smooth real-valued function on a manifold and the global topology of the manifold.
Synonyms:

Related terms: Morse function, critical point

Motion Capture

Methods for capturing movement data from a live source. The data are filtered and processed in order to replicate the same motion as the one performed by the live source on a control skeleton.
Synonyms:
Related terms: Animation Sequence, Animation Controller, Key Frame Animation

MRI

See Magnetic Resonance Imaging.
Synonyms: Magnetic Resonance Imaging
Related terms:

Multigrid algorithms

Algorithms designed to accelerate the convergence speed of basic relaxation iteration schemes (e.g. a Jacoby or Gauss-Seidel iteration) by computing corrections to the solution on coarser grids.
Synonyms:

Related terms: Approximation, Compression, Continuous Levels-of-detail (LOD) Model, Hierarchical B-spline (H-Spline), multigrid algorithms, Multiresolution, Discrete Levels-of-detail (LOD) Model, Wavelet

Multiresolution

An analysis and/or synthesis technique that allows manipulation of geometry at different resolutions, enabling both local and global modification, modulation of details at different frequencies.
Synonyms:

Related terms: Approximation, Compression, Continuous Levels-of-detail (LOD) Model, Hierarchical B-spline (H-Spline), multigrid algorithms, Multiresolution, Discrete Levels-of-detail (LOD) Model, Wavelet, Subdivision surface

Multi-Sensor Data Fusion

Study of the techniques for the integration of data from multiple sensors.

Node
An abstract class used to describe a family of "graph-like" nodes that can constitute diverse structural descriptors such as articulated skeletons.
Synonym:
Related terms: Skeleton, H-Anim, Joint, Segment, Site, Landmark

Non-photorealistic Rendering
It helps making comprehensible but simple pictures of complicated objects by employing different simplification techniques.
Synonyms:
Related terms: Rendering

NURBS
NonUniform Rational B-splines is a standard way in CAD for describing piecewise rational univariate and tensor product functions. NURBS use the numerically very stable B-spline basis for representing both the numerator and denominator of the rational function. NURBS is a very central geometry representation format in the STEP Standard (ISO 10303).
Synonyms:
Related terms: B-Spline curve/surface

Object Attribute
Synonyms: Abstract class for Smart Object attributes which can be divided into two main classes: Hand Posture and Location.
Related terms: Smart Object, Hand Posture

Object joint
Analogous to the joint node (Human joint), but adapted to describe smart objects.
Synonyms:
Related terms: Joint, Skeleton

Object segment
Node specialization for Smart Objects' structural descriptors. It contains information about each object part, including the geometry and a pointer to additional smart object attributes.
Synonyms:
Relater terms: clustering, aggregate, object segment, segment, segmentation, Skeleton

Occlusion
A portion of a surface is occluded to a sensor when there is a closer object hiding it to the sensor.
Related terms: Self-occlusion.

Offset surface
Coefficient set of points at a given distance of a given shape following the oriented normal to the input shape. It is a frequently used method for surface creation in CAD; if self-intersections occur, the offset has to be trimmed
Synonyms:
Related terms: Trimming an offset.

Orthogonal projection
Projection P applied to x such that P(x)-x is in normal direction of P(x).
Synonyms:
Relater terms: clustering, aggregate, object segment, segment, segmentation, Projection operator

Orthotomic

The orthotomic of a given curve/surface is the set of reflections of a given point around the tangents of a the curve/surface.

Out-of-core
When a problem is too large to fit into the primary memory (both physical and virtual) of the computer, it has to be processed using out of core techniques.

Parabolic line
A parabolic line on a surface consists of points where one of the principal curvatures vanishes.

Parametric continuity
Two C^k function pieces join smoothly at a boundary to form a joint C^k function if, at all common points, their k^{th} derivatives agree for k = 0,1,2, ,k. For k=0, it is a point continuity, for k=1, it is a continuity of first derivative, for k=2, it is a continuity of second derivative. It cannot be inferred that curve or surface pieces join smoothly iff the derivatives of the component functions agree.
Synonyms:
Related terms: Geometric continuity

Parametric curve/surface
Any curve/surface defined on a parametric domain. In case of surfaces, such domain can be usually tensor-based or triangular. Bezier, B-Splines, NURBS curves/surfaces belong to this category.
Synonyms:
Related terms: Algebraic curve/surfaces, B-Spline curve/surface, NURBS

Parametric modelling
Method of supporting the generation of model variations in CAD systems, storing an object as a main shape description and parameters for the dimensions and/or topology. After the assignment of specific values to the parameters, the modelling system generates a model variant accordingly.
Synonyms:
Related terms: CAD, Product Modelling

PCA
See Principal Component Analysis.
Synonyms: Principal Component Analysis
Related terms:

Pivot
The pivot makes the flexion axis rotate around the limb which is influenced by the joint.
Synonyms:
Related terms: joint

Pixel
A picture element, one or more measurements at a particular integer coordinate of a 2-D image.
Synonyms:
Relater terms: Image

Point Cloud
A set of uncorrelated points, usually in 3D, which have to be further elaborated to obtain a 3D model.

Point Set
See Point Cloud.

Synonym: Point Cloud

Polyhedral terrain
A polyhedral terrain is the image of a piecewise-linear function *f*. The most commonly used polyhedral terrain models are triangulated irregular networks (TINs), in which the domain partition forms a triangle mesh.

Post-processing
In a FE context, phase of the finite element analysis in which the analyst checks the validity of the solution, examines the values of primary quantities (such as displacements and stresses), and derives and examines additional quantities (such as specialized stresses and error indicators).
Synonyms:
Related terms: FEM, Simulation process, Pre-processing

Pre-processing
In a FE context, phase of the finite element analysis where the analyst develops a finite element mesh to divide the subject geometry into sub domains for mathematical analysis, and applies material properties and boundary conditions.
Synonyms:
Related terms: FEM, Simulation process

Principal Component Analysis

A technique that can be used to simplify a dataset; more formally it is a linear transformation that chooses a new coordinate system for the data set such that the greatest variance by any projection of the data set comes to lie on the first axis (then called the first principal component), the second greatest variance on the second axis, and so on. …
Synonyms:
Related terms:

Principal curvatures
The maximum and minimum of the normal curvature k^1 and k^2 at a given point on a surface are called the principal curvatures. The principal curvatures measure the maximum and minimum bending of a regular surface at each point.
Synonyms:
Related terms: Curvature, Focal Surface, Gaussian curvature, Generalised Focal Surface, Hedgehog Diagram, Inflection Point, Line of curvature, Mean curvature, Principal curvatures, Umbilical point

Product development process
A disciplined and defined set of tasks and steps which describe the normal means by which a company repetitively converts embryonic ideas into saleable products or services.
Synonyms:
Related terms: Product Modelling, CAD

Product Modelling
The entire product information modelling which describes the product completely and unambiguously. It deals with two general types of information: physical product design information represented by the design model and process information, represented by the process and data model.
Synonyms:
Related terms: Product Modelling, CAD, Design for X

Progressive Levels-of-detail (LOD) Models
They consist of a coarse shape representation and of a sequence of small modifications, that, when applied to the coarse representation, produce shape representations at successively finer levels of detail.
Synonyms:
Related terms: LOD

Progressive transmission
An incremental transfer of geometry between two different sites to alleviate transmission delays due to the fact that geometry tends to be very large. This incremental transfer typically tries to capture most of the geometry, in as early as possible stages of the transmission.

Projection operator
An operator that performs a projection. A projection P applied to x has the property that P(x) = P(P(x)), i.e. that projected points are stationary points of the projection operator. Commonly, the stationary points of a projection operator are a sub-manifold of the space they act on.
Synonyms:
Relater terms: Alignment, registration, orthogonal projection

Range image
A grid of distances (range points) that describe a surface in Cartesian (height field) or cylindrical coordinates.
A range scanner senses 3D positions on an objects surface and returns an array of distance values.
Synonyms: Range Scan
Relater terms: Image, pixel

Range scan
See Range image.
Synonyms: Range image
Relater terms: Image, pixel

Rapid prototyping
The speedy fabrication of sample parts of a product for demonstration, evaluation, or testing. It typically utilizes advanced layer manufacturing technologies that can quickly generate complex 3D objects directly from digital models. This computer representation is sliced into two-dimensional layers, whose descriptions are sent to the fabrication equipment to build the part layer by layer. Rapid prototyping includes many different fabrication technologies: stereolithography (STL), selective laser sintering (SLS), laminated object manufacturing (LOM), and fused deposition modelling (FDM) are a few examples.
Synonyms:
Related terms: Product Development Process

Raster Data
One method of storing, representing or displaying spatial data in digital form. It consists of using cell data arranged in a regular grid pattern in which each unit (pixel or cell) within the grid is assigned an identifying value based on its characteristics.
Synonyms:
Related terms: Range Image, pixel

Ray Casting
A central method for making photorealistic rendering.
Synonyms:

Related terms: Rendering

Ray-surface intersection

A specialization of Curve-surface intersection, where the space curve is an infinite straight line.
Synonyms:
Related terms: Contour, Curve-surface intersection, Ray-surface intersection, Self-intersection, Subdivision

Reconstruction

The process of making a surface geometry or volume type description of a 3D object based on measured points coordinates on the outer and inner surfaces of the 3D object.
Automatic reconstruction is a very challenging process, as the point sets can have wrong points, can miss points or do not contain a sufficient amount of point to describe critical surface regions accurately. If a point set is produced by combining measurement from different camera positions, there is often drifting of the data between the measurements, Such drifting will often result in false surface features.
Synonyms:
Related terms: Point cloud

Recovery

The process of rebuilding a valid 3D model that existed at an earlier stage in the design process after a crash of the modelling system, erroneous use of modelling functionality, rejection of the used design approach, or other mishaps.
Synonyms:
Related terms: CAD

Reeb graph

A topological structure encoding the evolution and the arrangement of the level sets. It is defined as the quotient space of a compact manifold M with respect to a real valued, continuous map f defined on it defined by the equivalence relation that collapses two point on M if and only if they have same image of f and belong to the same connected component of $f^{-1}(f())$.
Synonyms:

Related terms: Morse theory, critical point, Critical Point Configuration Graph, contour tree

Refinement operator

Operator to add primitives to a surface description. This typically increases the geometric fidelity of the representation.

Reflectance

The proportion of light aimed at an object that is reflected by it. An object's reflectance determines whether the object is perceived as light or dark.

Reflection line

A line consisting of all points p whose connection with some fixed point e, the eye, is reflected into a ray that meets a given fixed line L. Reflection lines, such as contour lines and isophotes, are very helpful to detect surface imperfections visually. They are very commonly in the automotive industry.
Synonyms:
Related terms: Silhouette, CAS, Structural feature

Registration

A rigid transformation that brings points of one range image into alignment with portions of a surface it shares with another range image.
Synonyms: alignment
Relater terms: ICP

Regular mesh
It is composed of simplices that are all similar (or belong to just few classes of congruent simplices) and have all vertices of the same degree (i.e. with the same number of incident simplices).
Synonyms:
Related terms: Mesh, Regular vertex

Regular square grid
.
Synonyms: Gridded elevation model
Related terms: DTM

Regular vertex
A vertex of valence six for triangle meshes, valence four for quad meshes and valence three for hexagonal meshes. These valences correspond to the regular tessellations of the Euclidean plane. All major subdivision schemes refine the control mesh by inserting regular vertices, thus isolated the vertices with other valences.
Synonyms:
Related terms: Mesh, Regular Mesh, Subdivision Surface

Remeshing
There is no precise definition, since it often varies according to the targeted goal or application. Nonetheless, it is possible to say that, given a 3D mesh, remeshing consists in computing another mesh, whose elements satisfy some quality requirements, while approximating well the input. *Quality* has several meanings. It can be related to the sampling, grading, regularity, size and shape of elements. Often a combination of these criteria is desired in real applications. Some remeshing techniques proceed by altering the input, and some generate a new mesh from scratch.

Rendering
The process of creating an image on the screen from a mathematical model of a three-dimensional object or scene, including texture, lights and other graphical information.
Synonyms:
Related terms: Non-photorealistic rendering, Ray-casting

Repairing
The process of removing (if possible) or reducing the gaps the between the delimiting curves of different surface elements.
When repairing the surfaces to ensure that the bounding curves fit better, the interior of the surfaces also have to be modified. Such modification can, if care is not taken, easily destroy important properties imposed on the interior of the surface. Automatic repair of CAD-models is thus an extremely challenging task.
Synonyms:
Related terms: Healing, CAD

Resultant

A projection operator which is used to eliminate a set of variables in an over-constraint polynomial system.

Reverse Engineering
The process of recreating a design by analysing a final product, speeding up the design and the evaluation process. A point cloud typically acquired using scanning techniques is used as a basis for constructing 3D CAD surface data from a physical model.
Synonyms:
Related terms: Product Development Process, Point Cloud, Reconstruction

RGB
An additive encoding of colors using the three primaries, red, green and blue. RGB is the common color model used in computer monitors and color images.
Synonyms:
Relater terms: Pixel, image, Colour mapping

Ridge
A ridge consists of the surface points where one of the principal curvatures attains an extremal value along its corresponding line of curvature.
Synonyms:
Related terms: Principal curvature, line of curvature

Sampling
The process of obtaining a sequence of point coordinates from a 3D model.

Scanning
The use of one or more Acquisition Devices in order to digitalize the shape of a real object.

Scattered data
Point data not lying in a regular grid structure. Scattered data can have line structures, be clustered, be fairly evenly dispersed or have many other structures.

Segment
(1) Portion of an H-Anim figure (Virtual Human) or Smart Object that represents its geometry and appearance.
(2) A collection of pixels that have similar properties (e.g., similar intensity values or texture) which differ from their surrounding pixels.
(3) A subset of a data set classified according to similar characteristics of the basic entities or to given criteria.
Synonyms: object segment, Human Segment
Relater terms: aggregate, segmentation, image segmentation, pixel, image, cluster, Skeleton

Segmentation
To split a data set into smaller subsets based on given classifications or criteria. Frequently used in image processing to analyse pictures and for detection. When reconstructing geometry objects from sampled points, segmentation techniques can be used to detect subsets of points belonging to the same mathematical surface.
Synonyms:
Relater terms: aggregate, object segment, segment, image segmentation, pixel, image, cluster

Selective Refinement
The extraction of shape representations from a LOD model in which the resolution varies continuously in different parts of the shape

Self-intersection
It occurs when a curve, surface or higher dimensional manifold intersects itself. For surfaces used in CAD self-intersections represents a situation that cannot be reproduced physically in production, and thus should be avoided.
Synonyms:
Related terms: Contour, Curve-surface intersection, Ray-surface intersection, Self-intersection, Subdivision

Self-occlusion
A surface is self-occluding when:
- Light cast from behind the surface does not illuminate it;
- The light source is in front of the surface but some closer portion of the surface blocks the incoming light;
- The light source is in front of the surface and the surface is illuminated, but some closer portion of the surface blocks the light coming from the surface.

Semi-algebraic curve/surface
A curve or surface which can, in addition, be described as the solution set of polynomial equalities and inequalities (e.g. B-Spline curves and surfaces).
Synonyms:
Related terms: B-Spline curve/surface, Algebraic curve/surface

Sensor
(1) An electronic device used to measure a physical quantity such as temperature, pressure or loudness and convert it into an electronic signal of some kind (e. g. a voltage).
Sensors can be classified in passive (not interacting with the scene) and active (interacting with the scene). Sensors are normally components of some larger electronic system such as a computer control and/or measurement system.
(2) Virtual entities that give to Virtual Humans the possibility to acquire information (stimuli) coming from their surrounding virtual environment. Virtual sensors let a VH see, hear and touch its virtual environment and react in consequence. The information acquired is then analyzed with different algorithms and/or Behavior Controllers that produce animation as output (the VH reacts to stimuli).
Synonyms:
Related terms: Animation Controller, Virtual Human, Behavioural Animation

Separatrix line
An integral line which connects a minimum to a saddle, or a saddle to a maximum.
Synonyms:
Related terms: Integral line, surface network

Shape classification
Given a database D containing n shapes, which are grouped into m classes, classification aims at determining the class a query shape, not necessarily belonging to D, most reasonably belongs
to.
Synonyms:
Related terms: Shape indexing, shape matching

Shape Deformation
Each operation or technique aiming at modifying a shape.
Synonyms:
Related terms: Influence area, Morphing

Shape descriptor

Synonym: Shape signature
Related terms: shape indexing, shape matching, shape classification

Shape from Shading
A method for determining the shape of a surface from the pattern of lights and shades in an image.
Synonyms:
Relater terms: Image, Range image

Shape Grammar
A shape grammar defines a language of design, i.e. it is a set of precise generating rules, which in turn, can be used to produce a language of shapes, to generate infinitely many instances of shape arrangements starting from an initial basic set of shapes. For example, shape grammars are widely used in architecture to model houses starting from pre-defined primitives (e.g. walls, windows, doors) and rules (e.g. each room must have at least one door).

Shape Indexing
Methodology relying on a lookup table approach for fast object labelling.
Synonyms:
Relater terms: image, matching, shape classification

Shape Interrogation
The process of extraction of information from a geometric model. Shape interrogation methods are used to analyse shapes with respect to different aspects like visual pleasantness, technical smoothness, geometric constraints, intrinsic surface properties or to highlight shape imperfections.

Shape Signature
Compact representation of the essence of the shape commonly used as a fast indexing and matching mechanism for shape retrieval. Effective shape signatures capture some global (e.g. scale, translation and rotation invariant) and partial geometric properties.
Synonyms: shape descriptor
Relater terms: image, shape indexing, matching, shape classification

Shock graph
A directed, planar graph in which the shock sets are grouped and classified according to the number of contact points and the flow direction.
Synonyms:
Relater terms: Shock set, medial axis, skeleton

Shock set
Dynamic view of the medial axis, which associates a direction and a speed of flow to the fire front propagation.
Synonyms:
Relater terms: medial axis, shock graph, skeleton

Silhouette
The outline of an object when seen from a given position. Silhouette curves are frequently used to enhance the 3D display of a CAD-model and when making 2D drawings from 3D objects.
Synonyms:
Related terms: Reflection line, CAS

Simplex (k-dimensional)
A *k-dimensional simplex*, or *k-simplex*, in the Euclidean space R^n is the locus of the points in R^n that can be expressed as the convex combination of *k+1* affinely independent points.
Synonyms:
Related terms: Simplicial complex, Mesh

Simplicial complex
A *d-dimensional simplicial complex* is a collection of simplices of dimension at most *d* in R^n such that all simplices spanned by vertices of the complex belong to the complex and the intersection of any two simplices is either empty or is a simplex belonging to both simplices.
Synonyms:
Related terms: Simplex (k-dimensional)

Simplicial mesh
A *simplicial mesh* is a mesh in which all cells are simplices. A d-dimensional simplicial mesh is a simplicial mesh which contains simplices of dimension *d* or lower.
Synonyms:
Related terms: Boundary Representation, B-rep, Simplicial complex, , Winged-edge data structure, Mesh

Simplification
Simplification can relate to a number of shape processing operations in CAD:
- Replace a boundary structure CAD model consisting of many surface elements by a CAD-model with significantly fewer surface elements, without changing the shape or design intent behind the model. Such simplification can be important to ensure simple meshing and remeshing of CAD-models when preparing for simulation of the CAD-model, or just to clean up the CAD-model.
- Remove unnecessary details before a CAD-model is meshed. Details not important for the simulation are removed, and regions where the actual geometry does not play any role for the outcome the simulation are given a simpler description.
Synonyms:
Related terms: CAD, Remeshing, Simulation Process

Simplified incidence graph
For a tetrahedral mesh, it encodes the following information: for each vertex *v,* a pointer to one edge incident at *t* v; for each edge *e*, the indices of the two extreme vertices of *e* and of one of the triangles sharing *e*; for each triangle *t*, the indices of the three edges bounding *t*, and the indices of the two tetrahedra sharing it; for each tetrahedron σ the indices of the four triangles bounding σ.
For a triangle mesh, it encodes the following information: for each vertex *v*, a pointer to one edge incident at *v*; for each edge *e*, the indices of the two extreme vertices of *e*, and of the two triangles sharing *e*; for each triangle *t*, the indices of the three edges bounding *t.*

Simulation process
Stage of the product development process which evaluates the physical behaviour of any engineering component constituting the whole product subject to various kinds of loads and conditions. Finite Element (FE) approaches are techniques widespread in industry to analyse the mechanical behaviour of a component. FE packages are able to solve sophisticated problems, ranging from structural analysis evaluating the performance of the product structure to thermal and electrical analyses, crash simulation, fluid flow and manufacturing processes, such as injection moulding and metal forming.
Synonyms:
Related terms: FEM, FE element, Product development process

Site
See Landmark.
Synonyms: Landmark
Related terms:

Skeletal linear structure
One-dimensional representation which encodes the decomposition of a shape into its relevant parts, or features, which may have either a geometric or an application dependent meaning.
Synonyms:
Related terms: Skeleton, Segment, center-line

Skeleton
(1) In algebraic topology, a p-skeleton is a simplicial sub-complex of a simplicial complex K that is the collection of all simplices of K of dimension at most p.
(2) Related with the notion of medial axis, the skeleton of a bounded open subset X is the set of centres of maximal balls, where an open ball B is maximal if every ball that contains B and is contained in X equals B.
(3) The skeleton of a shape is the reduced object representation that conforms to human visual perception and preserve the salient shape features.
(4) Implicit skeleton: in the field of implicit modelling, it is used for a set of geometric primitives to which a distance can be computed. These primitives are used for generating the field function that defines the surface. Skeleton-based implicit modelling can also be referred to as "Structural Implicit Modelling", since the skeleton defines an internal structure for the model.

Synonyms:
Related terms: Virtual Human, Joint, Articulation, Segment

Skeleton animation
Methods to animate an articulated skeleton by changing the values of the skeleton joints angles over time. The main methods are inverse and forward kinematics and Motion Capture. The result of a skeleton animation is stored as an animation sequence.

Synonyms:
Related terms: Skeleton joint angle, Animation Sequence, Animation Controller, Skeleton

Skeleton articulation

An articulation is the intersection of two limbs, which means it is a skeleton point where the limb which is linked to the point may move.
Synonyms: Join, Skeleton Joint, Articulation
Related terms: Skeleton

Skeleton-based implicit surface
An implicit surface whose field function is generated by a set of geometric primitives called *skeleton*.

Skeleton-driven deformation
It consists of deforming the skin to match the current posture of the control skeleton for articulated object animation or deformation. The basic approach consists in assigning a set of joints with weights to each vertex in the skin. The location of a vertex is then calculated by a weighted combination of the transformation of the influencing joints. Various extensions and enhanced complex methods have been proposed.
Synonyms:
Related terms: Skinning

Skeletonisation
The operation of extracting a skeleton.
Synonyms:
Related terms: Skeleton

Skeleton joint
A joint is the intersection of two segments, which means it is a skeleton point where the limb which is linked to the point may move. Skeleton joints are usually 3D Degrees of Freedom (DoF) rotational joints: flexion, pivot and twist.
Synonyms: Joint
Related terms: Skeleton

Skeleton joint angle
The angle between two segments (limbs) connected by a joint is called the joint angle.
Synonyms:
Related terms: Joint, Skeletal Animation

Skeleton pose
See Skeleton posture.
Synonyms: Skeleton pose
Related terms: Body posture, Body pose, Skeleton posture

Skeleton posing
It consists in specifying all joints angles values to define a skeleton pose or posture.
Synonyms: Skeleton pose
Related terms: Body posture, Skeleton posture

Skeleton posture
Specification of joint values describing a posture for an articulated character. A skeleton posture can be defined using forward/inverse kinematics, forward/inverse dynamics or even motion capture.
Synonyms:
Related terms: Body Posture, Animation Controllers

Skeleton skin
A geometric shape that represents the outer shape of an articulated object. This shape is attached to the articulated skeleton and animated with skeleton driven deformations according to the skeleton animation.
Synonyms:
Related terms: Skinning, Skeletal Animation

Skeleton skinning
(1) Applying skeleton driven deformation to the skeleton skin of an articulated character in order to adjust it to the current skeleton pose.

(2) Attaching geometric primitives or volumes to the joints and limbs of a control skeleton in order to define and control the shape of the skin. This information is further used in animation to control the skin deformation with respect to the control skeleton motion.
Synonyms: Skinning
Related terms: Skeletal Animation

Sketch
Drawing or other composition that is not intended as a finished work, but captures the basic elements and structure.
Synonyms:
Related terms: Conceptual design

Skin Interpolation

It consists in deforming a geometric surface (the skin) according to the animation of an underlying associated animation structure (skeleton, muscles) or to morph targets.
Synonyms:
Related terms: Skinning, Animation Controller, Morohing

Skin mapping

It consists of mapping a geometric surface called *skin* to a control skeleton in order to establish a direct correspondence between the control skeleton and the skin. This information is further used in animation to control the skin deformation with respect to the control skeleton motion.
Synonyms:
Related terms: Skeletal Animation, Skinning

Skinning

Refer to the surface representation used to draw a character in skeletal animation.
Synonyms: Skeleton Skinning
Related terms: Skeletal Animation, Skinning Mapping, Skinning Rigging

Skinning file

It describes a particular type of data used for animating deformable VH. A skinning file contains weights assigned to each vertex of the VH geometry. Such weights indicate the amount of deformation to apply when changing the posture. Deformations can be considered as vertex displacements driven by a function of rotation angles belonging to one or more joints. This allows for more aesthetical visual results when animating VH. Skinning algorithms can be used to obtain anatomically correct skin deformation by simulating the interaction between bones, muscles and skin.
Synonyms:
Related terms: Skinnind, Skeletal Animation

Skin rigging

See Skin mapping.
Synonyms: Skin Mapping
Related terms: Skeletal Animation, Skinning

Smart Object

Virtual object with which virtual humans are capable of manipulations. To implement this, the environment should be extended with some form of knowledge on how interactions between virtual humans and objects are to be carried out. Typical interactions are grasping and manipulation operations. A Smart Object is constituted by a hierarchical collection of nodes. The hierarchical organization specifies the relations between different Geometry and Attribute Sets composing an object.
Synonyms:
Related terms: Hand Posture, Smart Object Skeleton, Object Segment, Object Joint, Object Attribute

Smart Object skeleton

Hierarchical structure of object joints and/or object segments used to describe a smart object which usually including mobile parts.
Synonyms:
Related terms: Skeleton, Smart Object, Object Joint

Solid mechanics

Area of application of the continuum mechanics. It includes *structures* which are fabricated with solids. The computational structural mechanics emphasises technological applications to the analysis and design of structures.
Synonyms:
Related terms: continuum mechanics, simulation process

Solution

Iin a FE context, phase of the finite element analysis in which the program derives the governing matrix equations from the model and solves for the primary quantities.
Synonyms:
Related terms: FEM

Space-time constraints dynamics

It consists in attempting to meet specified constraints while minimising energy functions in order to add more control over the motion produced by dynamics.

Spline space

Piecewise polynomial manipulation of geometry draws from the ability to project geometry G_i in space S_i onto another subspace $S_{i+1} \subset S_i$. A Spline space is solely defined by the knot sequences τ and orders o. Both uniform and non-uniform knot sequences are considered. The use of uniform knot sequences allows the removal of every second knot, preserving the uniformity of the knot sequences and hence the pre-computation of the wavelet analysis.
Synonyms:
Related terms: B-Spline curve/surface, wavelet

Stable/unstable manifold of a critical point

Integral lines that converge to (originate from) a critical point of index ι form an ι-dimensional cell (($2-\iota$)-dimensional cell).
Synonyms:
Related terms: Critical Point, Integral line, Morse theory, Morse-Smale complex

Static problem

Continuum mechanics problem where the time dependence is not considered.
Synonyms:
Related terms: Continuum mechanics, Simulation Process

Stereo Vision

Vision is the act of perceiving and interpreting visual information. The word "stereo" comes from the Greek word "stereos" which means firm or solid. With stereo vision the objects are perceived as solid in 3D. In human beings the stereo vision is achieved by the presence of two eyes and the elaboration of the brain; in the digital world it is achieved by the presence of two sensors and the techniques to combine the measurements coming from them.
Synonyms:
Relater terms: range image, image, shape from shading, pixel, Acquisition Device, Acquisition planning

Straight-line skeleton

It is a type of skeleton for polygons which is defined as the union of pieces of angular bisectors traced out by the wave-front vertices during the propagation process from the polygon boundary.
Synonyms:
Related terms: Skeleton, medial axis, linear axis

Strain

Change per unit of length in a linear dimension of a part or specimen, usually expressed in %. Strain, as used with most mechanical tests, is based on original length of the specimen. *True* or *natural strain* is based on instantaneous length.
Synonyms:
Related terms: Simulation process, Strain energy, Boundary conditions

Strain Energy

Measure of energy absorption characteristics of a material under load up to fracture. It is equal to the area under the stress-strain curve, and is a measure of the toughness of a material.
Synonyms:
Related terms: Simulation process, Strain, Boundary conditions

Stress
Load on a specimen divided by the area through which it acts. As used with most mechanical tests, stress is based on original cross-sectional area without taking into account changes in area due to applied load. This is sometimes called conventional or engineering stress. *True stress* is equal to the load divided by the instantaneous cross-sectional area through which it acts.
Synonyms:
Related terms: Simulation process, Boundary Condition

Structural feature
Aesthetic features of the shape. In accordance with the stylists' activity, they represent the basic entities created in the preliminary phase of design, which are used for defining the surfaces constituting the product, thus having an important aesthetic impact. Structural features consist of the so called *contours* and *character lines*.
Synonyms:
Related terms: Form-feature, Feature, Character line, Detail Feature, Sketch, Styling process

Structured light
Structured light is the projection of a light pattern (plane, grid, or more complex shape) at a known angle onto an object. This technique can be very useful for imaging and acquiring dimensional information. The most often used light pattern is generated by fanning out a light beam into a sheet-of-light. When a sheet-of-light intersects with an object, a bright line of light can be seen on the surface of the object. By viewing this line of light from an angle, the observed distortions in the line can be translated into height variations.
Synonyms:
Relater terms: shape from shading, range image, stereo vision

Styling process
The set of tasks necessary to convert an idea of a product in a final aesthetic shape.
Synonyms:
Related terms: Conceptual design, Industrial design, CAS

Subdivision
The strategy often used in CAGD is to divide the geometric elements describing the problem into pieces. The idea behind subdivision is that the problem gets simpler when addressing sub pieces of the original geometry. In many cases this is true. However, if care is not taken and the subdivision is not performed in the proper location, the sub-problems can get more complicated than the original problem.
Subdivision algorithms play a central role in a number of algorithms in CAD:
- Visualization algorithms to produce an accurate triangulation of surfaces for display;
- Intersection algorithms for potentially simplifying the intersection problem.
Synonyms:
Related terms: Contour, Curve-surface intersection, Ray-surface intersection, Self-intersection, Subdivision surface

Subdivision curve

A curve described by an initial control polygon and a refinement rule. The subdivision curve is the limit of the progressively refined control polygon.
Synonyms:
Related terms: Subdivision, Subdivision surface

Subdivision matrix
A matrix describing the transformation of a part of the control mesh under one subdivision step. The spectral analysis of subdivision matrices is the main tool for studying a subdivision scheme.
Synonyms:
Related terms: Subdivision Surface

Subdivision surface
A surface described by an initial control mesh and a mesh refinement rule. The subdivision surface is the limit of the progressively refined control mesh.
Synonyms:
Related terms: Subdivision, Mask, Doo-Sabin scheme, Loop scheme, Catmull-Clark scheme, Butterfly scheme, Support

Sub-parabolic line
It is formed by the surface points where one of the principal curvatures takes an extremal value along the opposite line of curvature.
Synonyms:
Related terms: Line of Curvature

Support
The part of the subdivision surface affected by the change in position of a single point of the initial control mesh.
Synonyms:
Related terms: Subdivision surface

Support plane
Frame used to compute surface properties in a parametric setting. The support plane is used as the parameter domain for a piece of surface, where the mapping between surface and support plane is established by orthogonal projection.

Support Vector Machines (SVMs)
A family of algorithms that seek to divide a dataset using hyperplanes by margin maximisation. SVMs are often used as a supervised learning methods, applicable to both classification and regression.
Synonyms:
Relater terms: Decision trees, clustering

Surface network
Being f a Morse function defined over a domain D in R^2, it is a graph in which the nodes represent the critical points of f and the arcs the integral lines connecting the critical points.
Synonyms:
Relater terms: Critical point configuration graph, Morse-Smale complex, Morse theory, critical point

Surface patch

A selected part of a larger surface. In B-Spline modelling, any of the sub-surfaces which the global shape is decomposed in.
Synonyms:
Related terms: B-Spline, NURBS, CAD, B-Rep

Surface-surface intersection
Points and curves of coincidence of two surfaces. The points and curves lie in both surfaces, and thus, it is a way to compute curves points on a surface.
Synonyms:
Related terms: Contour, Curve-curve intersection, Curve-surface intersection, Ray-surface intersection, Self-intersection, Subdivision, Surface-surface intersection

Terrain
See Topographic surface.
Synonyms: Topographic surface
Related terms: DTM

Tessellation
Process forming or arranging continuous curves or surfaces in a piecewise, checked or mosaic pattern. In case of surfaces it is usually a triangulation.
Synonyms:
Related terms: Mesh

Tetrahedral mesh
A 3-dimensional simplicial mesh.
Synonyms:
Related terms: Simplicial Mesh

Tetrahedron bisection
The action of replacing a tetrahedron σ in a tetrahedral mesh with the two tetrahedra obtained by splitting σ at the middle point of its longest edge through the plane passing through such point and the opposite edge of σ. This rule is applied recursively to an initial decomposition of the cubic domain obtained by splitting it into six tetrahedra all sharing one diagonal.

Texture
In computer graphics, the digital representation of the characteristic appearance of a surface having a tactile quality.
Synonyms:
Relater terms: image, RGB

Thinning
Process of removing pixels or voxels from a discretised pixel-based or voxel-based representation of an object for generating a representation consisting of connected, unit-wide paths of pixels or voxels.
Synonyms:
Relater terms: distance surface, center-line, skeleton

Time of Flight
Scanning technology referring to devices that calculate distances (3D positions in space) by measuring the time of flight of very short pulses of light.
Synonyms:
Related terms: Acquisition Device

TIN
.
Synonyms: Triangulated Irregular Network
Related terms:

Topograghic distance
The topographic distance between two points p and q on a surface described by a C^2-differentiable function defined over a domain D in R^2 is the length of the path of steepest slope joining p and q.
Synonyms:
Relater terms: integral line

Topographic surface
The image of a real bivariate function f defined over a subset of points D in the Euclidean plane.

Topological graph
A simple unlabeled graph whose connectivity is considered purely on the basis of topological equivalence, so that two edges (v^1, v^2) and (v^2, v^3) joined by a node v^2 of degree two are considered equivalent to the single edge (v^1, v^3). This entity acts as a placeholder for a variety of structural descriptors. Topological graphs are different from the H-Anim or Smart Object skeletons, which are animation-oriented structures not suitable for other applications.
Synonyms:
Relater terms: surface network, Ree graph, contour tree, Critical point configuration graph

Triangle bisection
The action of replacing a triangle t in a triangle mesh with the two triangles obtained by splitting t at the middle point of its longest edge through the segment passing through such point and the opposite vertex of t. This rule is applied recursively to an initial decomposition of a square obtained by splitting it into two triangles by one of its diagonals.

Triangle mesh
A 2-dimensional simplicial mesh.
Synonyms:
Related terms: Simplicial Mesh

Triangulated Irregular Network (TIN)
A DTM based on the decomposition of the domain of a two-dimensional scalar field into a triangle mesh.
Synonyms: TIN
Related terms: DTM

Triangulation
Denoting $|S|$ the topological space underlying a simplicial complex S, ($|S| = \cup_{\sigma \in S} \sigma$), then a triangulation of the topological space M is a case of simplicial complex S such that $|S| = M$.
Improperly, the term triangulation is also used to denote the geometric realisation of a bi-dimensional simplicial complex (also known as *triangle mesh*); while tetrahedralisations are a subclass of three-dimensional simplicial complexes.
Synonyms:
Related terms: Simplicial Mesh

Trimming an offset
The operation of removing self-intersecting parts of offset surfaces. In fact, when the offset distance is larger than the minimal radius of curvature of the existing surface in some points and smaller in some others, some corresponding normals of the two surfaces will point in opposite directions causing self-intersections in the offset.

Synonyms:
Related terms: Offset surface

Trimming line
Line creating a restriction of the parametric space, i.e. of the definition domain of a parametric surface (Bezier, B-Spline, NURBS…).
Synonyms:
Related terms: B-Spline surface, NURBS

Twist
A torsion of the limb which is influenced by the joint.
Synonyms:
Related terms: Joint, Skeletal animation, Skeletal Joint Angle

Two-dimensional scalar field
A real bivariate function f defined over a subset of points D in the Euclidean plane.

Umbilical point
Surface point where the principal curvatures are equal. All the points in planar and spherical surface regions are umbilical.
Synonyms:
Related terms: Curvature, Focal Surface, Gaussian curvature, Generalised Focal Surface, Hedgehog Diagram, Inflection Point, Line of curvature, Mean curvature, Principal curvatures, Umbilical point

Uniform knot sequence
A knot sequence where all knots are equally spaced. One clear advantage of using uniform knot sequences can be found in the fact that the wavelet decomposition could be performed a-priori as the decomposition depends solely on the subspaces of the splines and is completely independent of the control points of the shapes.
Synonyms:
Related terms: B-Spline curve/surface, NURBS

Variable-Resolution Levels-of-detail (LOD) Model
It consists of a coarse shape representation and of a set of small modifications, organised into a partial order that allow performing selective refinement in such a way that the resolution be changed on a virtually continuous scale.
Synonyms:
Related terms: LOD

Variational Modelling
A paradigm used to find the "best" curve or surface among all solutions that meet a set of prescribed constraints. The constraints may result from the particular modelling technique used, for example, sample point approximation, or direct curve manipulation. It is typically formulated by minimising some energy functional.
Synonyms:
Related terms: Fairing

Vertex insertion
Vertex insertion in a simplicial mesh Σ consists of deleting a connected set of d-simplices from Σ, called the *region of influence* of the vertex insertion, and replacing them with a set of new d-simplices all incident at v . The region of influence is defined by the specific triangulation criterion used.
Synonyms:
Related terms: Boundary Representation, B-rep, Edge collapse, Simplicial mesh, Vertex insertion, Vertex removal, Vertex split, Winged-edge data structure

Vertex removal
Removal of a vertex *v* from a simplicial together with all the *d*-simplices incident at *v* from a *d*-dimensional simplicial mesh and re-triangulating the resulting star-shaped region formed by the union of the removed simplices. It is the inverse operation with respect to vertex insertion.
Synonyms:
Related terms: Boundary Representation, B-rep, Edge collapse, Simplicial mesh, Vertex insertion, Vertex removal, Vertex split, Winged-edge data structure

Vertex split
Expansion of a vertex *v* in a simplicial mesh into an edge *e*.
A vertex split is the inverse operation with respect to an edge collapse. There are two cases: vertex v is an extreme vertex of e (inverse of half-edge collapse) or not (inverse of a full-edge collapse). In the latter case, any simplex incident in *v* either expands of one dimension and becomes incident in *e*, or becomes incident in one of the extreme vertices of e. In the former case, only a subset of simplices incident at *v* are affected by the vertex split, forming the so-called region of influence (specified in the split operation).
Synonyms:
Related terms: Boundary Representation, B-rep, Edge collapse, Simplicial mesh, Vertex insertion, Vertex removal, Vertex split, Winged-edge data structure

View
In a 3D modeller, a view indicates a projection of an object according to some planes, typically the main planes of the coordinate reference system.
In the product development process, a view is the product information required by a development phase. Since the various phases of the development process have different goals, they require proper digital model and information of the product itself together with proper tools to treat them. It is therefore necessary to transform the model from one point of view to another one.

Synonyms:
Related terms: Product Development Process, Product Modelling, Design for X

Virtual Human
Specialized instance of an articulated character. The model can be synthesised in a variety of ways and can represent a real or a virtual person. VHs are characterized by a set of general attributes (sex, nationality, race, …), and structural descriptors (skeleton, geometry, landmarks, etc..).
Synonyms: Virtual Character
Related terms: Individual Descriptor, Morphological Descriptor, Articulated Character, Animation Sequence, Animation Controller, Smart Object

Vision
The investigation of how the human visual perception works, and how simulating it artificially.
Synonyms:
Relater terms: image

Voxel
An abbreviation for "volume element" or "volume cell." It is the 3D conceptual counterpart of the 2D pixel. Each voxel is a quantum unit of volume and has a numeric value (or values) associated with it that represents some measurable properties or independent variables of the real objects or phenomena.
Synonyms:
Relater terms: pixel

Watermarking
Adding a hidden pattern in an image, surface, or sound, that can be checked algorithmically, but is not perceived by the human observer.

Watershed
The watershed of a C^2-differentiable function f defined over a domain D is the set of points of D which do not belong to any catchment basin.

Water tightness
In general there are small gaps between the surface elements describing the shells (inner and outer) in a CAD-model. In a simulation model such small gaps are not allowed, the elements constituting the simulation model has to have an exact match, or in other words be water tight.

Wavelet
Multiresolution representation based on wavelets have been developed for parametric curves and surfaces, meshes and surfaces of arbitrary topology and even for volume data.Wavelets provide a framework to decompose a complex function into a "coarser" low resolution part, together with a collection of detail coefficients and different resolution levels, all necessary in order to recover the original function.
Synonyms:

Related terms: Approximation, Compression, Continuous Levels-of-detail (LOD) Model, Hierarchical B-spline (H-Spline), multigrid algorithms, Multiresolution, Discrete Levels-of-detail (LOD) Model, Minkowski sum

Winged-edge data structure
It explicitly encodes all entities forming a mesh. For each edge e, the data structure maintains the indices of the two extreme vertices of e of the two faces bounded by e, and of the four edges that are both adjacent to e and are on the boundary of the two faces bounded by e. Vertices and faces are also encoded: for each vertex v, a pointer to any edge incident in v, and for each face f, a pointer to an edge bounding f is maintained.
Synonyms:
Related terms: Boundary Representation, B-rep, Edge collapse, Simplicial mesh, Vertex insertion, Vertex removal, Vertex split, Winged-edge data structure

Zippering
The process of merging polygonal meshes generated from different 3D scans of an object into one mesh. Multiple scans are often necessary because the objects measured are self-occluding.
Synonyms:
Relater terms: model composition mesh merging, mesh