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## COMPUTER-AIDED GEOMETRIC DESIGN AND COMPUTER GRAPHICS:

## INDUSTRIAL FORMATS

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## Standard industrial formats

A keypoint in industry is the ability to transfer geometric information between different CAD/CAM software.
Many different formats have been developed for this purpose. Among them:
VDA (Germany)
-Developed by VDA (Verband Der Automobilindustrie = Association of the German Automotive Industry) -Appeared in the early 90s (first version in 1991). -Based on polynomial representation.
SET (France)
-SET stands for Standard d'Échange et de Transfert -Developed as a French standard in 1985 by Aerospatiale

- Intended to store the $\mathbf{1 0 0 \%}$ of any product definition data
-IGES stands for Initial Graphics Exchange Specification
-Developed in the early 80s, as a part of a project with the National Bureau of Standards.
-Based on B-spline
representation.


## CATIA (USA)

-Developed by IBM.
-Appeared in the early 90s (first version in 1991).

- Used for many automotive and aerospatial companies

STEP
-STEP (Standard for the Exchange of Product Model Data) is an international standard born to improve the IGES format.

## PHIGS

-PHIGS (Programmer's Hierarchical Interactive Graphics System) is an international standard specifying a device-independent interactive graphics programming interface. -Emerged in the mid of 80 's.
-Incorporated NURBS in 1992 as part of PHIGS PLUS extension.

## IGES format

- IGES (Initial Graphics Exchange Specification) was developed in the early 80s, as a part of a project with the National Bureau of Standards.
- About 1988, PDES (Product Data Exchange Specification) was also developed, containing all the IGES features. Here, IGES implies IGES/PDES.


## Some Features:

- NURBS curves, surfaces and 3D-solids are supported.
- Bézier curves and surfaces are considered particular cases of the B-splines ones.
- Only positive weights are allowed.
- Control points and weights are separate items in this format.

| Example: Some Entities: |
| :--- |
| Door of a car <br> 5733 Kb. <br> (73426 lines) |$\quad$| 100 | Entity |
| :---: | :---: |
| 110 | Arcs |
| 112 | Lines |
| 126 | Bespline curves |
| 128 | Nurbs surface |
| 144 | Trimmed Nurbs surface |

## IGES format

## Based on Bspline representation.

Section
$\downarrow$


## Maximum GME point tolerance: <br> Minimum GME point tolerance:

0.01
0.01

1H, 1H; 4HIGES,15Higesfile_32.igs,25HI-DEAS Master Series 1.3c, 8HIGES 5.1,32,38,8,308,15,25HI-DEAS Master Series 1.3c,1.00000000,2 $2 \mathrm{HMM}, 1,1.00000000,13 \mathrm{H} 941121.132843,0.01000000,128.21290168,4 \mathrm{HNONE}$,
Geometric Entity

| Entity | 126 |
| :---: | ---: |
| $\vdots$ | 126 |
| $\vdots$ | 126 |

Entity

 $\begin{array}{rr}0 & 1 \\ 3 & 5 \\ -- & - \\ 0 & 1 \\ 0 & 3 \\ 3 & 3 \\ 0 & 1 \\ 0 & 3\end{array}$
$128,1,1,1,1,0,0,1,0,0,0.0,0.0,1.0,1.0,0.0,0.0,1.0,1.0,1.0$ $26.28690082,120.94084305,63.59124477,22.28692137$, $20.94084305,63.59124477,26.28690082,20.94084305,0.0,1.0$, 0.0,1.0;
$126,1,1,0,0,1,0,0.0,0.0,0.23063978,0.23063978,1.0,1.0$, $0.45214146,0.0,0.0,0.45214146,0.23063978,0.0,0.0$,
$0.23063978,0.0,0.0,0.0$;
$126,1,1,0,0,1,0,0.0,0.0,0.23063978,0.23063978,1.0,1.0$, 63.59124477,24.09547793,120.94084305,63.59124477,
$24.09547793,97.87686532,0.0,0.23063978,0.0,0.0,0.0$;
S0000001 S0000002 S0000003 S0000004 G0000001 G0000002 G0000003 G0000004
$\left.\begin{array}{c}\text { B-spline } \\ \text { surface }\end{array}\right]$
$126,1,1,0,0,1,0,0.54785854,0.54785854,1.0,1.0,1.0,1.0$, $0.45214146,0.23063978,0.0,0.0,0.23063978,0.0,0.54785854$, 1.0,0.0,0.0,0.0;


