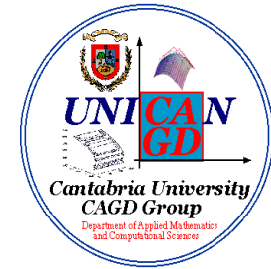




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**COMPUTER-AIDED GEOMETRIC DESIGN  
AND COMPUTER GRAPHICS:  
INDUSTRIAL FORMATS**

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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 100% of any product definition data

## IGES (USA)

- 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 aerospace 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

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<http://personales.unican.es/iglesias>

- *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:

*Door of a car*

5733 Kb.  
(73426 lines)



## Some Entities:

<i>Number</i>	<i>Entity</i>
100	Arcs
110	Lines
112	Spline curves
126	B-spline curves
128	Nurbs surface
144	Trimmed Nurbs surface

# IGES format



Section

Based on B-spline representation.



Geometric Entity

Geometric Entity

B-spline surface

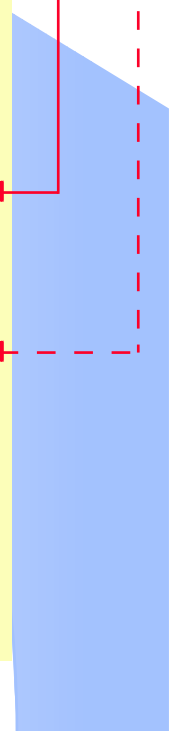
B-spline curve

Maximum GME point tolerance: 0.01  
 Minimum GME point tolerance: 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  
 2HMM,1,1.00000000,13H941121.132843,0.01000000,128.21290168,4HNONE,  
 4HNONE,9,0,;

128	1	0	1	0	0	0	000010000D	1
128	0	3	5	1			PLANE 0D	2
126	6	0	1	0	0	0	001010500D	3
126	0	0	3	1			LINE 0D	4
126	9	0	1	0	0	0	000010000D	5
126	0	3	3	1			LINE 0D	6
126	12	0	1	0	0	0	001010500D	7
126	0	0	3	1			LINE 0D	8
.	.	.	.	.	.	.	.	.
128,1,1,1,1,0,0,1,0,0,0.0,0.0,1.0,1.0,0.0,0.0,1.0,1.0,1.0,1.0,	1P	1						
1.0,1.0,63.59124477,22.28692137,120.94084305,63.59124477,	1P	2						
26.28690082,120.94084305,63.59124477,22.28692137,	1P	3						
20.94084305,63.59124477,26.28690082,20.94084305,0.0,1.0,	1P	4						
0.0,1.0;	1P	5						
126,1,1,0,0,1,0,0.0,0.0,0.23063978,0.23063978,1.0,1.0,	3P	6						
0.45214146,0.0,0.0,0.45214146,0.23063978,0.0,0.0,	3P	7						
0.23063978,0.0,0.0,0.0;	3P	8						
126,1,1,0,0,1,0,0.0,0.0,0.23063978,0.23063978,1.0,1.0,	5P	9						
63.59124477,24.09547793,120.94084305,63.59124477,	5P	10						
24.09547793,97.87686532,0.0,0.23063978,0.0,0.0,0.0;	5P	11						
126,1,1,0,0,1,0,0.54785854,0.54785854,1.0,1.0,1.0,1.0,	7P	12						
0.45214146,0.23063978,0.0,0.0,0.23063978,0.0,0.54785854,	7P	13						
1.0,0.0,0.0,0.0;	7P	14						

80 characters



# IGES format

## B-spline curve

$n=5$

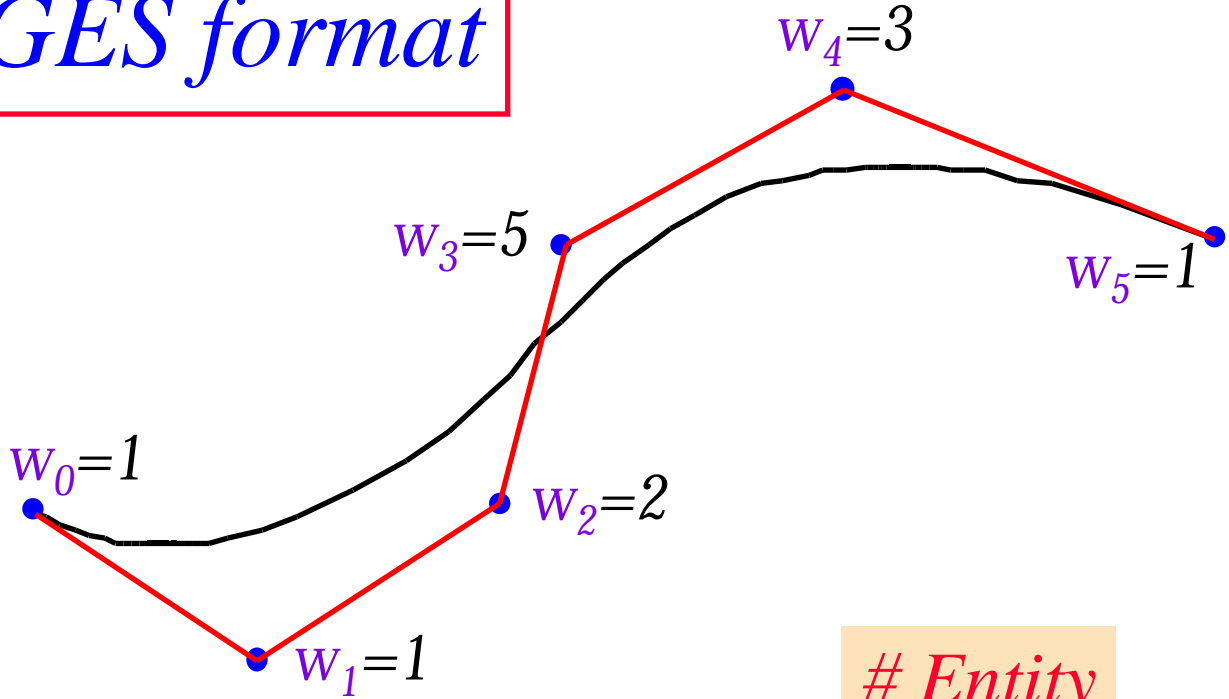
degree=5

?planar=y

?open=y

?rac=y

?periodic=n



### Knots vector

```

126, 5, 5, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
1.0, 2.0, 5.0, 3.0, 1.0, -8487.830078, -1017.196167, 1976.249877,
-5487.829833, -1075.826661, 1976.249877, -2247.831298, -1014.450135,
1976.249877, -1387.829101, -913.063355, 1976.249877, 2387.829589,
-851.671998, 1976.249877, 7387.830078, -910.270875, 1976.249877, 0.0,
1.0, 0.0, 0.0, 0.0, 0.0, 0.0;
    
```

# Entity

Section

559P	3102
559P	3103
559P	3104
559P	3105
559P	3106
559P	3107

ending parameter value

Weights

Control Points

starting parameter value

# Line