北京建筑大学
BEIJING UNIVERSITY OF CIVIL ENGINEERING AND ARCHITECTURE

BIM可视化引擎

周小平 博士/教授/博导

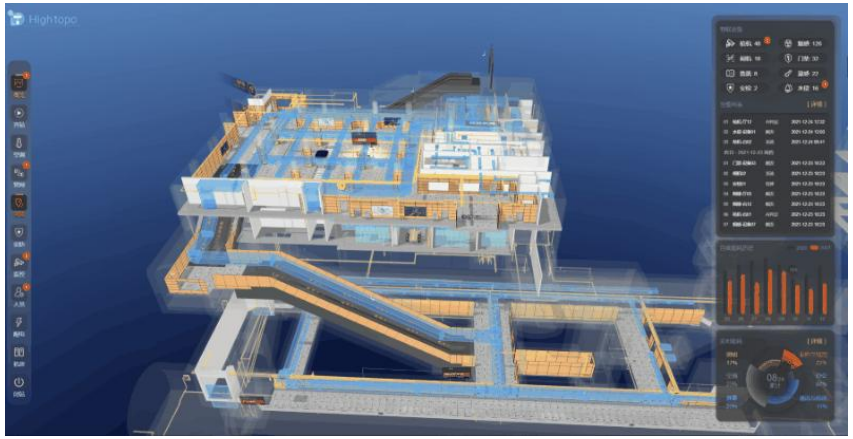
BIM可视化引擎

C/S架构可视化引擎

(桌面可视化引擎)

B/S架构可视化引擎

(Web可视化引擎)



云渲染可视化引擎

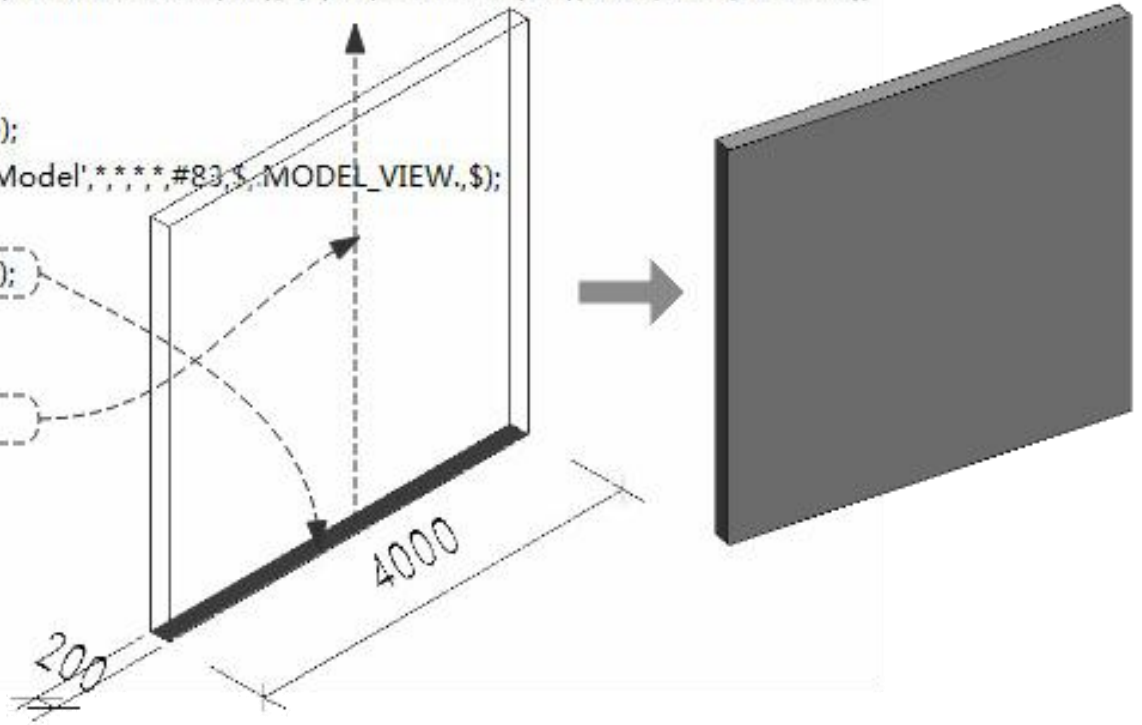
Type	Description
Point	2 or 3 dimensional point(s)
PointCloud	3 dimensional points prepresented by a point list
Curve	2 or 3 dimensional curve(s)
Curve2D	2 dimensional curve(s)
Curve3D	3 dimensional curve(s)
Surface	2 or 3 dimensional surface(s)
Surface2D	2 dimensional surface(s) (a region on ground view)
Surface3D	3 dimensional surface(s)
SectionedSurface	swept surface(s) created by sweeping open profiles along a directrix
FillArea	2D region(s) represented as a filled area (hatching)
Text	text defined as text literals

AdvancedSurface	3 dimensional b-spline surface(s)
GeometricSet	points, curves, surfaces (2 or 3 dimensional)
GeometricCurveSet	points, curves (2 or 3 dimensional)
Annotation2D	points, curves (2 or 3 dimensional), hatches and text (2 dimensional)
SurfaceModel	face based and shell based surface model(s), or tessellated surface model(s)
Tessellation	Tessellated surface representation(s) only
Segment	partial geometry of curves that shall not be rendered sparately from the main curve
SolidModel	including swept solid, Boolean results and Brep bodies; more specific types are:
SweptSolid	swept area solids, by extrusion and revolution, excluding tapered sweeps
AdvancedSweptSolid	swept area solids created by sweeping a profile along a directrix, and tapered sweeps
Brep	Faceted Brep's with and without voids
AdvancedBrep	Brep's based on advanced faces, with b-spline surface geometry, with and without voids
CSG	Boolean results of operations between solid models, half spaces and Boolean results

Clipping	Boolean differences between swept area solids, half spaces and Boolean results
BoundingBox	simplistic 3D representation by a bounding box
SectionedSpine	cross section based representation of a spine curve and planar cross sections. It can represent a surface or a solid and the interpolations of the between the cross sections is not defined
LightSource	light source with (depending on type) position, orientation, light colour, intensity and attenuation
MappedRepresentation	representation based on mapped item(s), referring to a representation map. Note: it can be seen as an inserted block reference. The shape representation of the mapped item has a representation type declaring the type of its representation items.

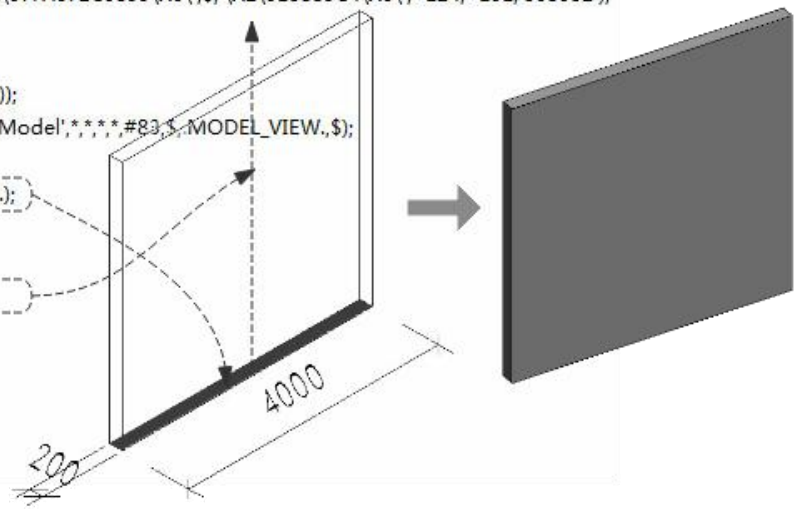
桌面BIM可视化引擎


```
#155= IFCWALLSTANDARDCASE('32hQVc$MXAJ86PBPmkLbKd',#41,'\X2\57FA672C5899\X0\',$,'\X2\5E3889C4\X0\',#124,#151,'308532');
  #151= IFCPRODUCTDEFINITIONSHAPE($,$,(#130,#148));
    #130= IFCSHAPEREPRESENTATION(#86,'Axis','Curve2D',(#128));
    #148= IFCSHAPEREPRESENTATION(#88,'Body','SweptSolid',(#138));
      #88= IFCGEOMETRICREPRESENTATIONSUBCONTEXT('Body','Model',*,*,*,*,#83,$,.MODEL_VIEW.,$);
      #138= IFCEXTRUDEDAREASOLID(#136,#137,#19,4000.);
        #136= IFCRECTANGLEPROFILEDEF(.AREA.,$,#135,4000.,200.);
          #135= IFCAXIS2PLACEMENT2D(#133,#25);
            #133= IFCCARTESIANPOINT((2000.,0.));
            #25= IFCDIRECTION((-1.,0.));
        #137= IFCAXIS2PLACEMENT3D(#6,$,$);
          #6= IFCCARTESIANPOINT((0.,0.,0.));
        #19= IFCDIRECTION((0.,0.,1.));
```



Web BIM可视化引擎


```
#155= IFCWALLSTANDARDCASE('32hQVc$MXAJ86PBPmkLbKd',#41,'\X2\57FA672C5899\X0\',$,'\X2\5E3889C4\X0\',#124,#151,'308532');
  #151= IFCPRODUCTDEFINITIONSHAPE($,$,(#130,#148));
    #130= IFCSHAPEREPRESENTATION(#86,'Axis','Curve2D',(#128));
    #148= IFCSHAPEREPRESENTATION(#88,'Body','SweptSolid',(#138));
      #88= IFCGEOMETRICREPRESENTATIONSUBCONTEXT('Body','Model',*,*,*,*,#83,$,.MODEL_VIEW.,$);
      #138= IFCEXTRUDEDAREASOLID(#136,#137,#19,4000.);
        #136= IFCRECTANGLEPROFILEDEF(.AREA.,$,#135,4000.,200.);
          #135= IFCAXIS2PLACEMENT2D(#133,#25);
            #133= IFCCARTESIANPOINT((2000.,0.));
            #25= IFCDIRECTION((-1.,0.));
        #137= IFCAXIS2PLACEMENT3D(#6,$,$);
          #6= IFCCARTESIANPOINT((0.,0.,0.));
        #19= IFCDIRECTION((0.,0.,1.));
```



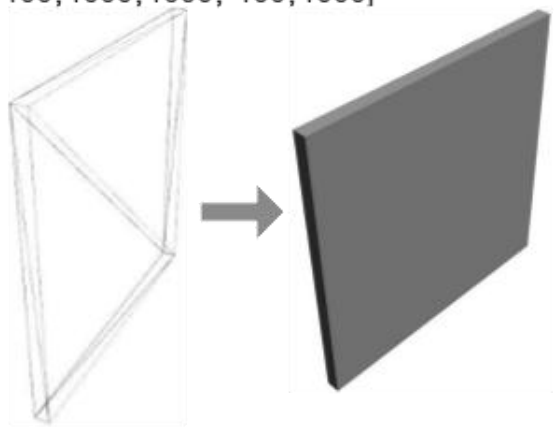
IFC格式定义墙体：

桌面可视化引擎

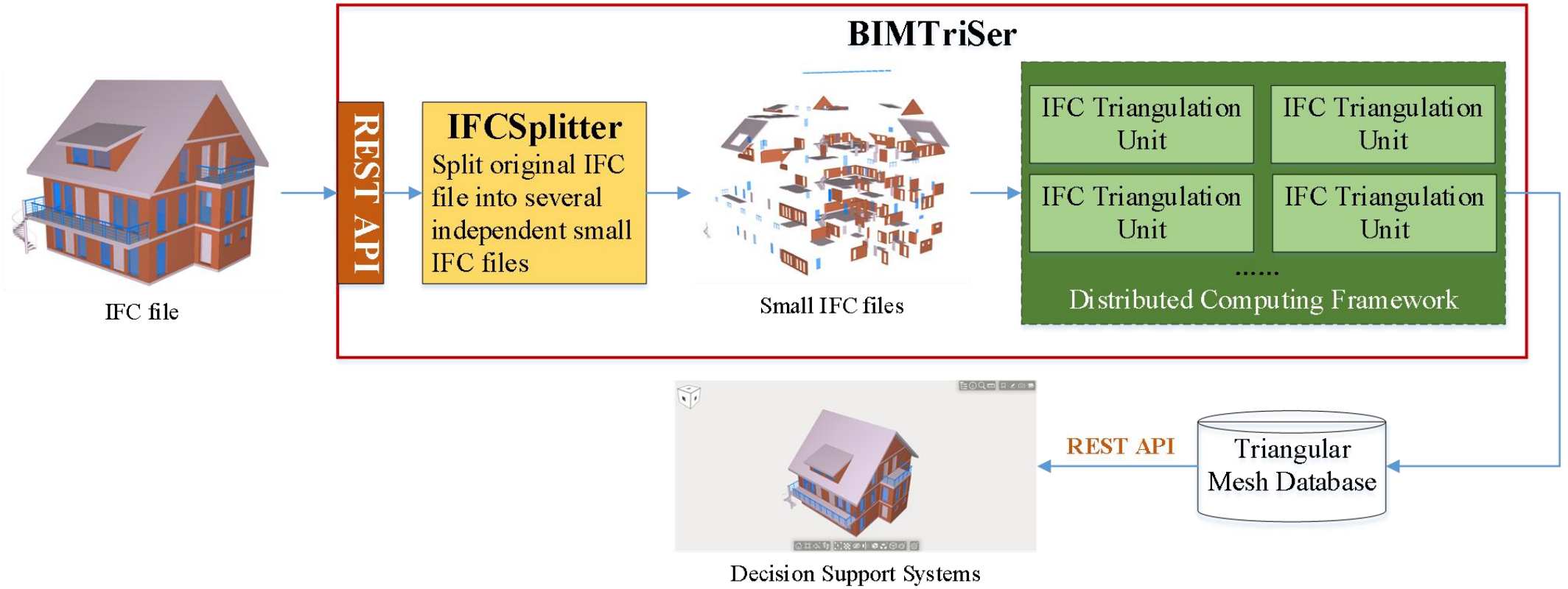
三角化后的墙体：

Web可视化引擎


```
{
  "positions": [
4000,100,0,4000,100,4000,0,100,0,0,100,4000,0,100,0,0,100,40000,-100,0,0,-100,4000,0,-100,0,0,-100,
                4000,4000,-100,0,4000,-100,4000,4000,-100,0,4000,-100,4000,4000,100,0,4000,100,4000,4000,100,0,0,
                100,0,0,-100,0,4000,-100,0,4000,100,4000,0,100,4000,0,-100,4000,4000,-100,4000]
    "indices": [ 1,0,3,3,0,2,5,4,6,7,5,6,9,8,10,11,9,10,13,12,14,
                15,13,14,17,19,18,17,16,19,22,23,21,23,20,21],
   "normals": [ 0,1,0,0,1,0,0,1,0,0,1,0,-1,0,0,-1,0,0,-1,0,0,-1,0,0,
                0,-1,0,0,-1,0,0,-1,0,0,-1,0,1,0,0,1,0,0,1,0,0,1,0,0,
                0,0,-1,0,0,-1, 0,0,-1,0,0,-1,0,0,1,0,0,1,0,0,1,0,0,1],
     "matrix": [ 1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1],
     "colors": [0.5019608,0.5019608,0.5019608,1],
  "materials": [ 0,0,0,0,0,0,0,0,0,0,0,0 ],
       "type": "IfcWallStandardCase"
       "guid": "32hQVc$MXAJ86PBPmkLbKd",
}
```

Web BIM可视化引擎



[1] Zhou X, Zhao J, Wang J, et al. Parallel computing-based online geometry triangulation for building information modeling utilizing big data[J]. Automation in Construction, 2019, 107: 102942.
[2] Zhou X, Wang M, Liu Y S, et al. Heterogeneous network modeling and segmentation of building information modeling data for parallel triangulation and visualization[J]. Automation in Construction, 2021, 131: 103897.

BIM云渲染

由UE5云渲染的BIM模型

BIM可视化引擎

主　　讲　　周小平
监　　制　　刘德利
审　　稿　　王雨康
统　　筹　　斯　　琴
录　　制　　李　　想