

Altair HyperWorks 2024 新版本发布会

AI 赋能技术创新，开启仿真新篇章

2024年8月28日 | 北京



HYPERWORKS 二次开发新内容: 全面支持PYTHON

目录

1 基于Python二次开发

Python API 概述

2 前处理开发

HyperMesh Python API

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HyperView/HyperGraph Python API

4 Extensions

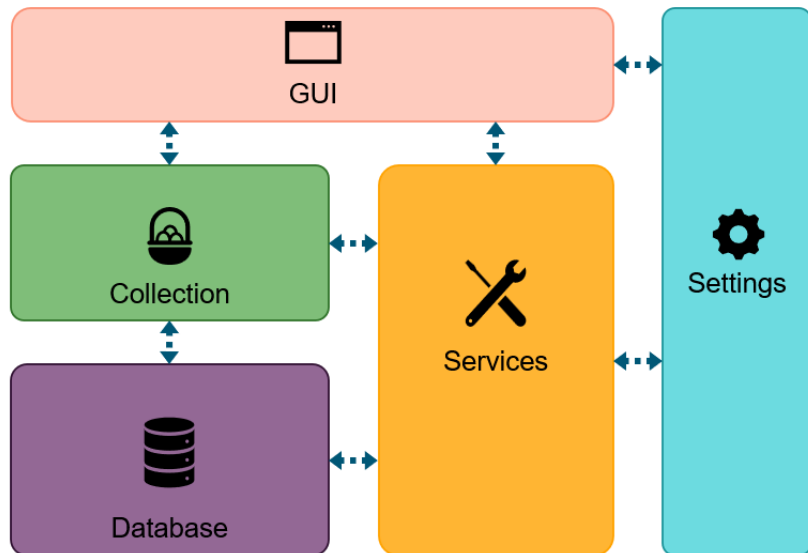
HyperWorks的插件管理器

5 Task Manager

代替从前的Process Manager

Python二次开发

API架构 —— TCL

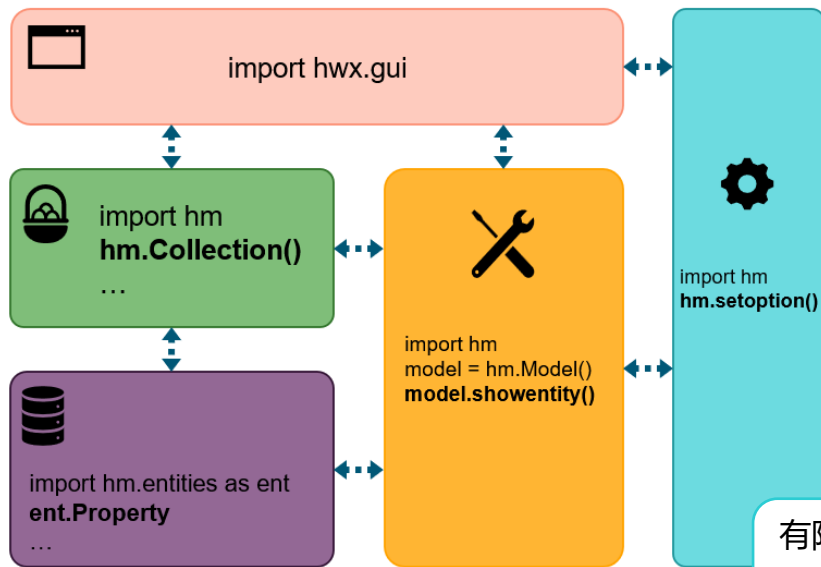


Tcl编程语言

- 小众编程语言，网上学习资料少（有人甚至认为是Altair发布的）
- 第三方代码包极其有限（很多人可能不知道它的存在）
- 代码运行效率低
- 在HW二次开发常用场景中，难以实现对PPT、Word的操作（生成计算报告）、与服务器的交互、对数据库的读写、多进程的实现、数学函数的调用

Python二次开发

API架构 —— Python



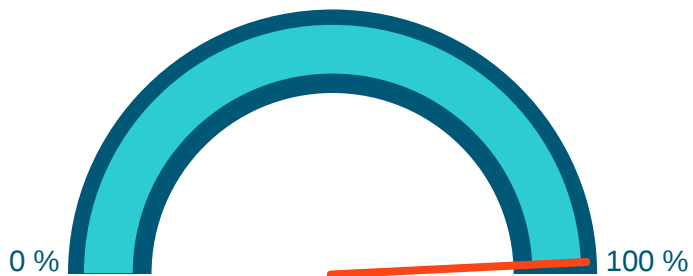
Python编程语言

- 大众编程语言，网上学习资料浩如烟海
- 第三方代码库应有尽有，安装简单
- PPT、Word、Excel、服务器的交互、数据库的读写、多进程的操作等等变的简单
- 玩转数据分析、AI
- 千呼万唤始出来，HW全面支持Python二次开发

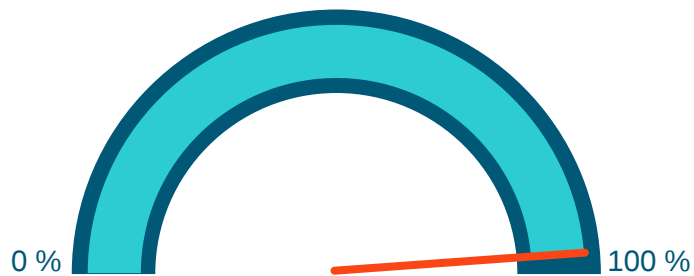
有限元模型是单元，是节点，是坐标，是点云，是数据；
工况计算结果是标量，是向量，是张量，是曲线，是数据；

基于Python二次开发

2024.1 API覆盖率



99 %
Modify Functions

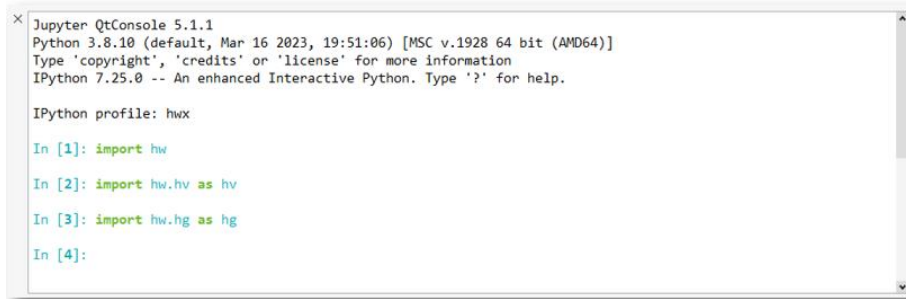
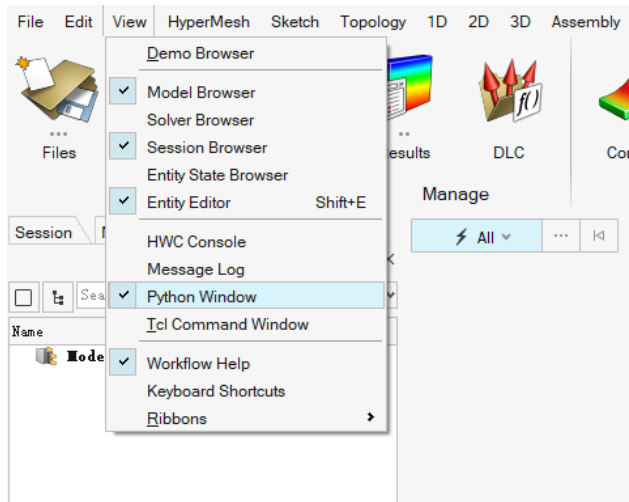


98 %
Query Functions

基于Python二次开发

开发支持环境

HyperMesh 安装目录中包含的 Python 3.8.10 发行版包括数百个流行的包和库，比如 Pandas、NumPy、SciPy、TensorFlow、openpyxl、Matplotlib等



- `import hw` will give you access to the framework classes and functions (see [hw Module](#)).
- `import hm` will give you access to HyperMesh client classes and functions (see [hm Module](#)).
- `import hm.entities` will give you access to HyperMesh client entity classes (see [hm.entities Module](#)).
- `import hw.hv` will import the HyperView classes (see [hw.hv Module](#)).
- `import hw.hg` will import the HyperGraph classes (see [hw.hg Module](#)).
- `import hw.taskmanager` will import the Task Manager classes (see [hw.taskmanager Module](#)).
- `import hw.gui` will import the GUI Toolkit classes (see [GUI Toolkit](#)).

基于Python二次开发

兼容TCL开发

```
tcl.EvalScript('hm_answernext yes')  
tcl.EvalScript('*deletemodel')
```

python

Clearing scalar and iso plot using HWC in Python

```
import hw  
  
hw.evalHWC('result scalar clear "Stress, vonMises, Max, Analysis System')  
hw.evalHWC('result iso clear')
```

Sourcing a Tcl file in Python and assigning the returned value to a variable

```
import hw  
  
returned_str = hw.evalTcl('source {C:/Scripts/post_processing_util.tcl}')
```

AnimationTool class

CaptureImageTool class

Color class

Font class

HyperGraphWindow class

HyperViewWindow class

Page class

Session class

Window class

evalHWC function

evalTcl function

前处理开发

前处理开发

Hypermesh API

Tcl	Python
Entity Types	Entity Classes
Entities	Entity Objects
Entity Data Names	Entity Attributes
Entity Mark	Entity Collections
Modify & Query Commands	Model Methods

前处理开发

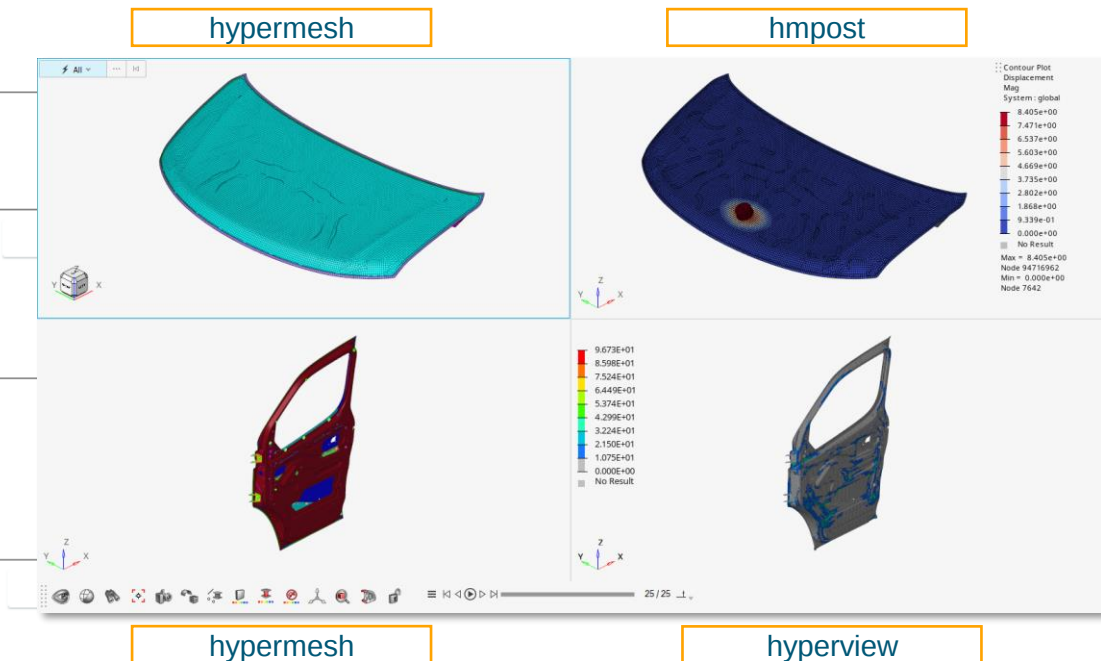
多模型、多结果场景

- 类 `hm.Session`

```
s = hm.Session()
m = hm.Model(s.get_all_models()[0])
m.readfile(hmFile, 0)
```

- 类 `hm.Model`

```
model = hm.Model()
elems = hm.Collection(model, ent.Element)
# Querying element IDs from a collection
for e in elems:
    print(e.id)
```



前处理开发

Hypermesh entity

hm.entities Module

Placeholder text for some info about `hm.entities` module and its content.

Most of the datanames for the entities below can be used with the same format as their TCL interface counterpart that you can find in this link [datanames](#)

Examples

The examples are on how we create an entity and grabbing a handle for an existing entity. The examples will be performed on "bumper.hm" in Demo folder.

Example_01 - Creating a node and material with the name "Steel"

```
1 import hm
2 import hm.entities as ent
3
4 # Reading model and grabbing its handle
5 modelfile = r'C:\Program Files\Altair\2023\hwdesktop\demos\hm\bumper.hm'
6 model = hm.Model()
7 model.readfile(modelfile,0)
8
9 # Exposing the initial number of nodes
10 initNode_col = hm.Collection(model,ent.Node)
11 print(f'Number of Nodes: {len(initNode_col)}')
12
13 # Create a Node
14 nodec = ent.Node(model)
15 print(f'Created Node id {nodec.id}')
16
17 # Create a Material and name it 'Steel' (Check it in Model Browser)
18 mat1 = ent.Material(model)
19 mat1.name = 'Steel'
20 mat1.cardimage = 'MAT1'
21 print(f'Material Name: {mat1.name}')
```

On this page

Examples

Accelerometer class

Alefsiprojection class

Alereferencesystemcurve class

Alereferencesystemgroup class

Alereferencesystemnode class

Alereferencesystemswitch class

Alesmoothing class

Aletanktest class

Analysis class

Analysisparameter class

Attachment class

Attachmentcontrol class

Attachmentcontroldefault class

Axisymmetry class

Bag class

Beamsectcol class

Beamsection class

Behavior class

Block class

Body class

Box class

Card class

Chart class

Clearance class

Collection class

Comment class

Component class

Tcl Entity Type

Tcl configure

Python Entity Class

Loads

9	LoadAcceleration
3	LoadConstraint
6	LoadFlux
1	LoadForce
2	LoadMoment
4	LoadPressure
5	LoadTemperature
8	LoadVelocity

Every hypermesh entity is a Python object

Python works with entity object, Tcl works with entity IDs

前处理开发

Entity attributes

API架构支持更多的 entity attributes (data names)

- Editable & invisible attributes
- Tabular attributes

Name	Value
Name:	loadcol1
ID:	6
Color:	
Include:	[Main Model]
Card Image:	FREQi
User Comments:	Hide In Menu/Export
FREQ:	☐
FREQ1:	☒
NUMBER_OF_FREQ1 =:	3
Data: ID, ...:	
FREQ2:	☐
FREQ3:	☐

ID	F1	DF	NDF
1	50.0	50.0	1
2	200.0	50.0	1
3	400.0	50.0	1

```

In [32]: loadcol = ent.Loadcol(model,6)

In [33]: loadcol.FREQ1
Out[33]: 1

In [34]: loadcol.NUMBER_OF_FREQ1
Out[34]: 3

In [35]: loadcol.FREQ1_DF_ARRAY
Out[35]: array([50., 50., 50.])

In [36]: loadcol.FREQ1_F1_ARRAY
Out[36]: array([ 50., 200., 400.])

In [37]: loadcol.FREQ1_NDF_ARRAY
Out[37]: array([1, 1, 1], dtype=int32)

```

forces

Unless otherwise specified, data names are accessible in level 3 only.

engineering_type

The engineering type of load. Engineering loads act on set entities. Valid values are:

- 0 - Classic load
- 3 - Directional engineering load
- 14 - Composite plate load

Type: unsigned integer

The following data names are available for both classic and engineering loads:

attributemax

The number of attributes owned by this entity.

Type: unsigned integer

collector

Pointer to the collector that owns the load.

Type: pointer (levels 2, 3, and 4)

config

The configuration of the entity.

- 1 - Force

Type: unsigned integer

definedentity

True if the entity is defined, false otherwise.

Type: Boolean

entityid

The ID of the entity the load is attached to.

Type: integer

entitytype

The type of the entity to which the load is applied.

- 1 - node
- 3 - comp
- 10 - set

预处理开发

Mark vs Collection

Tcl: markid 1, markid 2 (可以创建两个)

*createmark

Supported Options

"all"

Place all active entities on *mark_id*.

"displayed"

Place displayed entities on *mark_id*.

"inactive"

Place only inactive entities on *mark_id*.

"retrieve"

Place saved entities on *mark_id*. Some panels allow you to save entities. See the *saveusermark command, as well.

"reverse"

Entities existing on *mark_id* are removed. All other entities are put on *mark_id*.

"by all nodes" id

Place elements on *mark_id* that consist of all the listed node IDs.

"by assem" ids or names

"by assem id" ids

"by assem name" names

"by assembly" ids or names

"by assembly id" ids

"by assembly name" names

Place entities on *mark_id*, if they are referenced by the listed assembly IDs or names.

"by attribute" attribute

Place entities on *mark_id*, if they have the specified attribute name/ID.

Python: Collection Class (可以创建任意数量)

hm.Collection()

Advanced Methods

HyperMesh Python API allows user to create collections using more advanced methods, either via specialized functions or via filters.

In the [hm Module](#), you will find four specialized functions that return a collection object:

- **CollectionByAdjacent** - creates a collection of entities adjacent to the entities in the source collection.
- **CollectionByAttached** - creates a collection of entities attached to the entities in the source collection.
- **CollectionByDisplayed** - creates a collection of displayed entities.
- **CollectionByFace** - creates a collection of entities that represent the same face as the entities in the source collection.

Filter classes provide an additional mechanism to define more complex rules of creating an entity collection.

The three standard filters are:

- **FilterByAttribute** - entity selection based on their properties/attributes. The search string follows the same syntax as the Browser search in the GUI (see [Find and Search for Entities \(altair.com\)](#) for more information).
- **FilterByCollection** - entity selection by reference (e.g. elements by properties, nodes by elements etc.).
- **FilterByEnumeration** - entity selection by providing a list UUIDs, either entity IDs or names.

前处理开发

Modify commands, Query commands

- Python API 是对 Tcl API 的补充
- Python API 使用户能够执行Tcl API 所具备的相同功能。
- Python API 的函数名字与Tcl API的函数名字一致

modify command 示例

```
# Tcl command
*createmark elems 1 displayed
*createvector 1 0 0 1
*translatemark elems 1 1 500.0

# Python command
elem_col = hm.Collection(model, ent_Element)
model.translatemark(elem_col, hm.hwTriple(0.0,0.0,1.0), 500.0)
```

query command 示例

```
# Tcl command
*createmark elems 1 displayed
hm_getmass elems 1

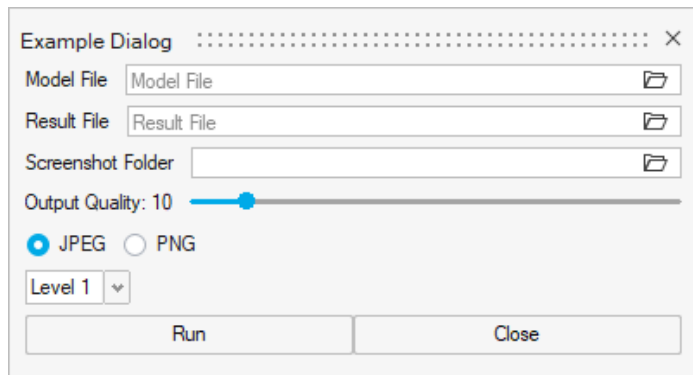
# Python command
elem_col = hm.Collection(model,ent.Element)
model.hm_getmass(elem_col)
```

前处理开发

GUI

类 hwx.gui

该模块并非 HyperMesh 所独有 - 它在HyperWorks架构中是通用组件，在 Altair Compose、Altair Inspire 和Altair SimLab中同样适用



Containers

[CollapsibleFrame Class](#)

[CsvFileDialog Class](#)

[Dialog Class](#)

[DockWindow Class](#)

[MessageDialog Class](#)

[Frame Class](#)

[HFrame Class](#)

[VFrame Class](#)

[GridFrame Class](#)

[TabWidget Class](#)

[WidgetStack Class](#)

Layouts

[Layout Class](#)

[BoxLayout Class](#)

[HBoxLayout Class](#)

[VBoxLayout Class](#)

[GridLayout Class](#)

[ExpanderLayout Class](#)

Widgets

[ButtonBase Class](#)

[ButtonGroup Class](#)

[CheckBox Class](#)

[ComboBox Class](#)

[Cursor Class](#)

[DoubleEdit Class](#)

[ExpanderButton Class](#)

[IconLabel Class](#)

[IntEdit Class](#)

[Label Class](#)

[Legend Class](#)

[LineEdit Class](#)

[ListBox Class](#)

[PopupMenu Class](#)

[ProgressBar Class](#)

[PushButton Class](#)

[RadioButton Class](#)

[RadioButtons Class](#)

[HRadioButtons Class](#)

[VRadioButtons Class](#)

前处理开发

帮助和支持



完善的Python
帮助文档



API语法提示插件



Altair 社区论坛



HyperWorksPyAPI v0.0.3

Altair Engineering altair.com | 98 | ★★★★★

A Visual Code extension for HyperMesh, Simlab & Inspire Python APIs

禁用 卸载 自动更新 设置

后处理开发

后处理开发

hyperview

☰ On this page

Collection class

Element class

ExportModelH3D class

FilterByPlane class

FilterByScalar class

FilterBySphere class

LegendScalar class

LegendTensor class

LegendVector class

Model class

Node class

Note class

Part class

PartAssembly class

PartSet class

Result class

ResultDefinitionIso class

ResultDefinitionScalar class

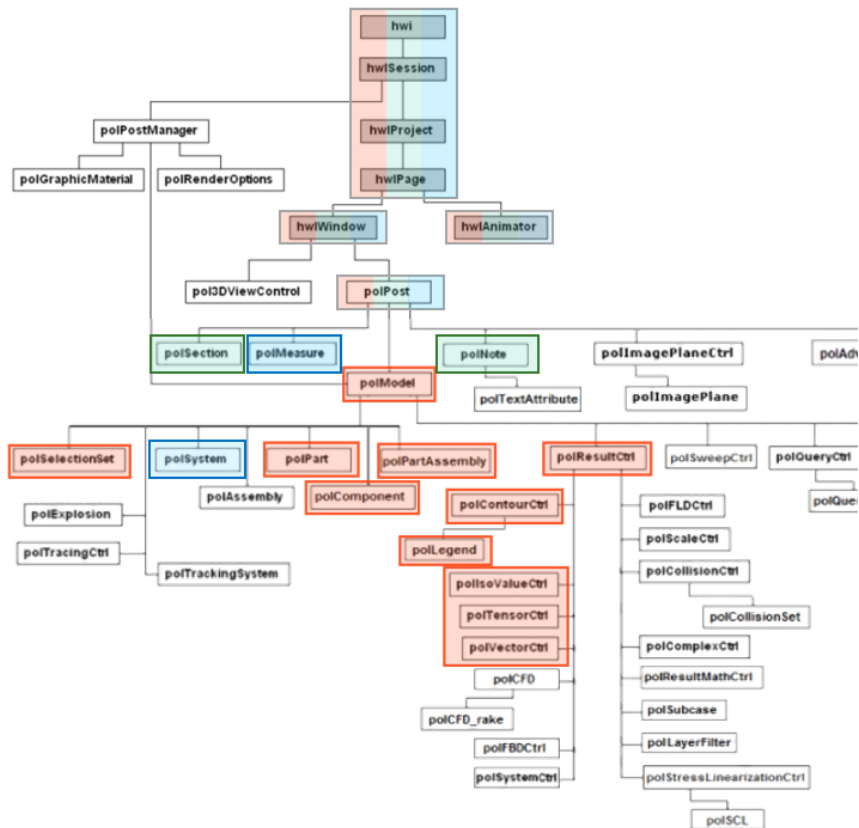
ResultDefinitionTensor class

ResultDefinitionVector class

ResultDisplayIso class

SectionCutPlanar class

SectionCutSpherical class



Version 2024.1

Version 2024.0

Version 2023.1

后处理开发

hyperview

比如类 `CaptureVideoTool()`

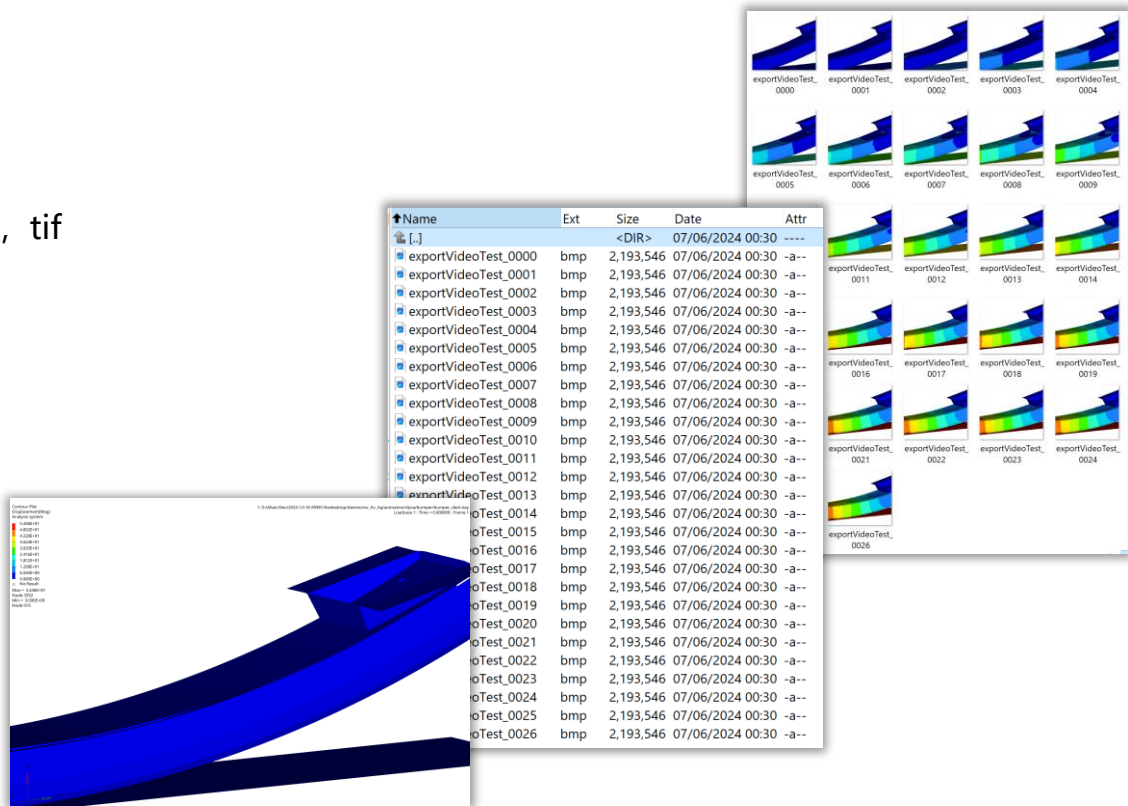
- 支持的视频格式有 avi, amf, gif
- 支持的图片格式有 jpeg, png, bmp, tif

```
cvt1 = CaptureVideoTool()
cvt1.dimension = 'pixels'
cvt1.area = 'page'
cvt1.width = 3000
cvt1.height = 2000
```

```
cvt1.file = videoFile
cvt1.capture()
```

```
cvt2 = CaptureVideoTool()
cvt2.top = 0.1
cvt2.left = 0.3
cvt2.bottom = 0.9
cvt2.right = 0.7
```

```
cvt2.file = videoFile
cvt2.capture()
```

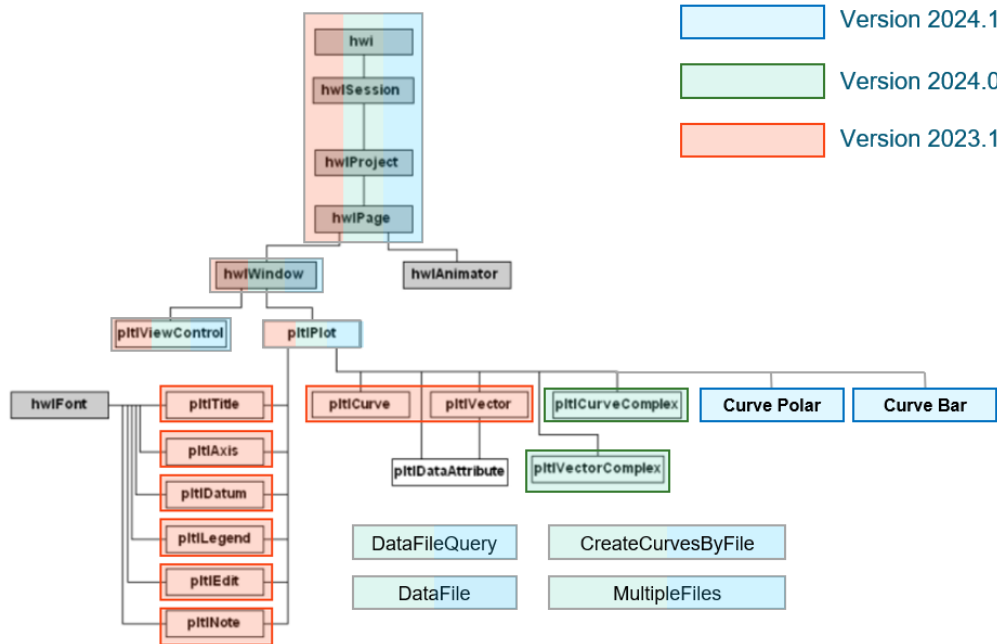


后处理开发

hypergraph

☰ On this page

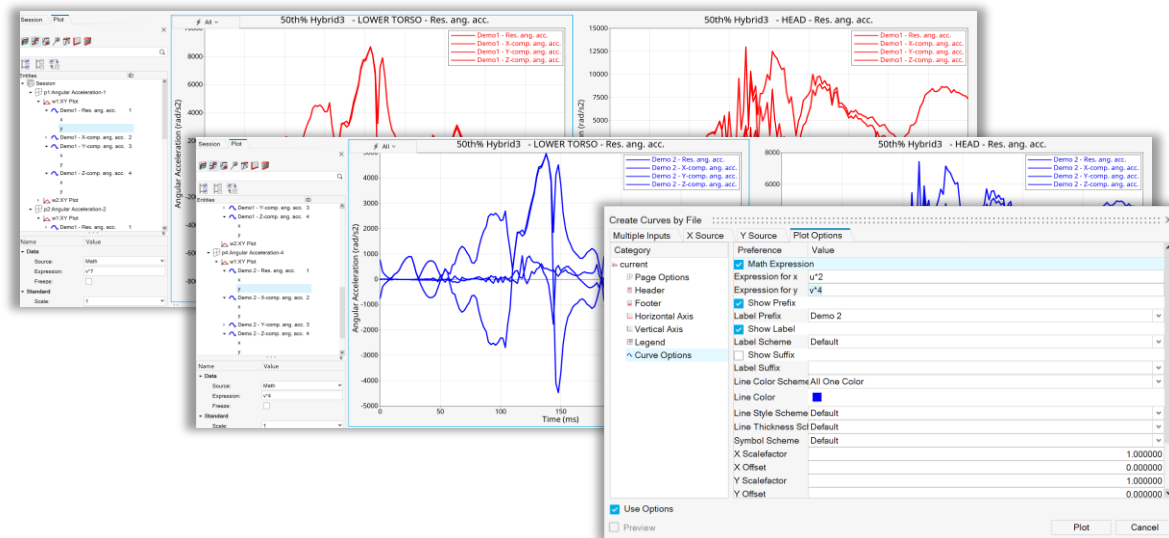
- AxisHorizontal class
- AxisVertical class
- CreateCurvesByFile class
- CurveXY class
- CurveComplex class
- DataQuery class
- DataFileQuery class
- DatumHorizontal class
- DatumVertical class
- ExportCurves class
- Footer class
- Header class
- Legend class
- MathXY class
- MultipleFiles class
- Note class



后处理开发

hypergraph

比如类 `CreateCurvesByFile()` `CreateCurveOptions()`



```
# Define channels
dataTypeList=['Time', 'Angular Acceleration', 'Index']
dataType=dataTypeList[1]

# Create curves by file properties
createCurves=CreateCurvesByFile()
createCurves.file = plotFile
createCurves.yDataType=dataType
createCurves.yRequest='all'
createCurves.yComponent='all'
createCurves.layoutType=1
createCurves.layoutOrganisation='onePlotPerRequest'
```

```
# Link plot options
createCurves.curveOptionsEnabled=True
```

```
# Define plot options
createCurves.curveOptions='CurveOptions1'
createCurvesOptions = CreateCurvesOptions('CurveOptions1')
createCurvesOptions.curveUseMath=True
createCurvesOptions.curveXexpression='u*3'
createCurvesOptions.curveYexpression='v*7'
createCurvesOptions.curveShowLabelPrefix=True
createCurvesOptions.curveLabelPrefix='Demo1'
createCurvesOptions.curveLineColorsScheme='allOneColor'
col1=Color(rgb=(255,0,0))
createCurvesOptions.curveLineColor=col1
```

```
# Define plot options
createCurvesOptions = CreateCurvesOptions('CurveOptions2')
createCurvesOptions.curveUseMath=True
createCurvesOptions.curveXexpression='u*2'
createCurvesOptions.curveYexpression='v*4'
createCurvesOptions.curveShowLabelPrefix=True
createCurvesOptions.curveLabelPrefix='Demo 2'
createCurvesOptions.curveLineColorsScheme='allOneColor'
col2=Color(rgb=(0,0,255))
createCurvesOptions.curveLineColor=col2
```

```
# Run create curves
createCurves.curveOptions='CurveOptions1'
createCurves.run()
createCurves.curveOptions='CurveOptions2'
createCurves.run()
```

EXTENSIONS & TASK MANAGER

Extensions

- **Extension** 以XML文件配置工作流和执行脚本，支持添加菜单启动，支持调用TCL和Python
- **宏命令** HW2024不再支持.mac宏文件，去掉了Utility Menu，相应的脚本文件转为一个extension插件

```
<section name="Extension">

  <entry name="name" value="Extension Capture Ribbon Demo" />
  <entry name="resources" value="images" />
  <entry name="minProductVersion" value="2022.2" />
  <entry name="version" value="1.0" />
  <entry name="autoLoad" value="true"/>
  <entry name="author" value="Altair" />
  <entry name="description" value="HyperWorks extension demo showing you how to incorporate your custom content in the application." />
  <entry name="supportedClient" value="HyperWorksDesktop" />
  <entry name="tclscript" value="global-init.tcl" />

  <section name="profile" value="HyperMesh">
    <entry name="ribbonxml" value="hm/hm-ribbon.xml" />
  </section>

  <section name="profile" value="HyperView">
    <entry name="ribbonxml" value="hv/hv-ribbon.xml" />
  </section>

  <section name="profile" value="HyperGraph">
    <entry name="ribbonxml" value="hg/hg-ribbon.xml" />
  </section>

</section>
```



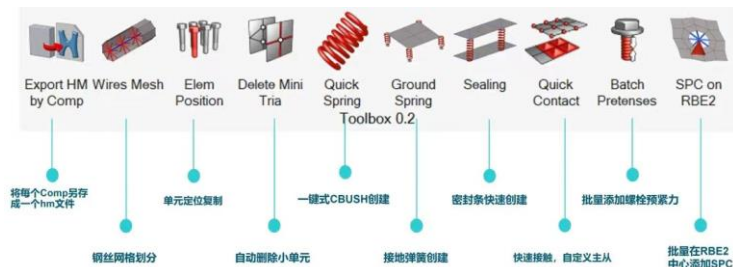
Extensions

工具箱

从hyperworks2022版本开始，我们广泛征求客户的需求，发布了四期工具箱



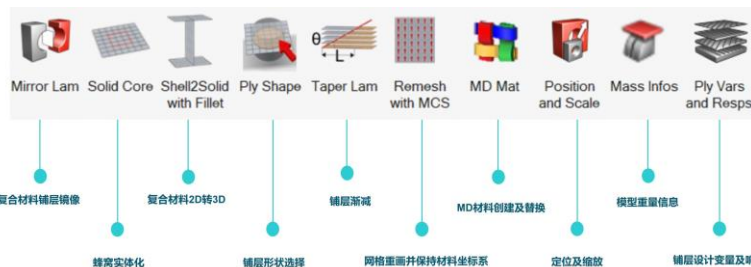
V0.1



V0.2



V0.3



V0.4

Extensions

The screenshot displays the Altair Extensions management interface. It features two main extension cards:

- Vehicle Tools**: Provided by Altair. Description: "The Vehicle Tools extension provides a comprehensive library of sub-systems and tools for building and analyzing Cars, Trucks and Motorcycles. Contains a page with ribbons, tools and library folders in Entity Browser for the MotionView client." It includes 'Details' and 'Remove' buttons and a toggle switch.
- NVH前后处理流程**: Provided by Altair ESG | Version 1.0. Description: "NVH前后处理工具由赛达尔官方二次开发团队开发交付 用于前处理工况加载和后处理自动报告". It also includes 'Details' and 'Remove' buttons and a toggle switch.

A floating window titled **NVH** is shown, containing icons for LoadSteps, NTF, VTF, and IPI, and a description: "Hyperworks extension demo showing you how to incorporate your custom content in the application." It has its own 'Details' and 'Remove' buttons and a toggle switch.

In the background, several overlapping graphs are visible, each showing multiple colored lines (red, green, blue) representing different data series over time. The graphs are labeled with Chinese text, such as "左前悬架安装点-驾驶员耳处" (Left front suspension mounting point - driver's ear) and "右前悬架安装点-驾驶员耳处" (Right front suspension mounting point - driver's ear).

Extensions



Engine type



Engine preview



Load file

Extensions Search



Vehicle Tools
Altair

The Vehicle Tools extension provides a comprehensive library of sub-systems and tools for building and analyzing Cars, Trucks and Motorcycles.

Contains a page with ribbons, tools and library folders in Entity Browser for the MotionView client.

Details
Remove

☐



发动机载荷提取工具
Altair ESG | Version 1.0

发动机载荷提取工具由阿尔塔官方二次开发团队开发交付用于发送机载荷的快速提取 适配4缸及6缸发动机

Details
Remove

☐

 **Extension**
Altair | Version

HyperWorks extension demo showing you how to incorporate your custom content in the application.

Contains custom features (file menu entries, ribbons and toolbars) for three different clients: HyperMesh, HyperView and HyperGraph.

Details
Remove

☐

发动机参数预览
载荷文件
发动机类型

打开模型

D:/SVN/EngineLoadCalculationTool/trunk/EngineLo

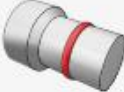
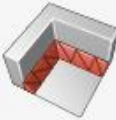
保存模型

新模型

序号	名称	单位	数值
1	Cylinder_Distance	mm	79.7
2	Cylinder_Diameter	mm	73.84
3	Stroke	mm	85.7
4	Conrod_Length	mm	124.85
5	CG_of_Conrod_from_Big_End	mm	28.661
6	Piston_Mass	kg	0.235
7	Conrod_Mass	kg	0.42875
8	Conrod_Moment_of_Inertia_bx	kg*mm*mm	911.67
9	Conrod_Moment_of_Inertia_ly	kg*mm*mm	1044.2
10	Conrod_Moment_of_Inertia_lzz	kg*mm*mm	152.28
11	Conrod_Moment_of_Inertia_bx	kg*mm*mm	0.52367
12	Conrod_Moment_of_Inertia_lxz	kg*mm*mm	-0.5
13	Conrod_Moment_of_Inertia_lyz	kg*mm*mm	-0.26

Extensions



Setting
Clean
T-Seam
C-Seam
Mesh

Extensions



Vehicle Tools
Altair

The Vehicle Tools extension provides a comprehensive library of sub-systems and tools for building and analyzing Cars, Trucks and Motorcycles.

Contains a page with ribbons, tools and library folders in Entity Browser for the MotionView client.

Details
Remove
●



焊缝工具箱
Altair ESG | Version 1.0

焊缝工具由奥沃尔官方二次开发团队开发交付 用于前处理建模 创建实体焊缝以及焊缝网格

Details
Remove
●

Altair | version 1.0

HyperWorks extension demo showing you how to incorporate your custom content in the application.

Contains custom features (file menu entries, ribbons and toolbars) for three different clients: HyperMesh, HyperView and HyperGraph.

Details
Remove
●

General
✕

Width Height ☐ Show Tips

☒ Merge Seam Surfs

Patch Fracture Surfs ☒ Not ☐ Triangle ☐ Quadrangle

☐ Width of the heat affected zone

☒ Both ☐ Up/In ☐ Down/Out

☒ OutSide ☐ Two Sides

☐ Seam Toe Offset To FreeEdge If Distance <

☐ Geom Repair Tool

Seam options

Seam Type

Edges

Bottoms

☒ Exist cambered bottom surface

Preview

R_W
R_H

Create

Seam Mesh

Seam Surfs ☐ All

Mesh Size

Mesh Layer

Task Manager

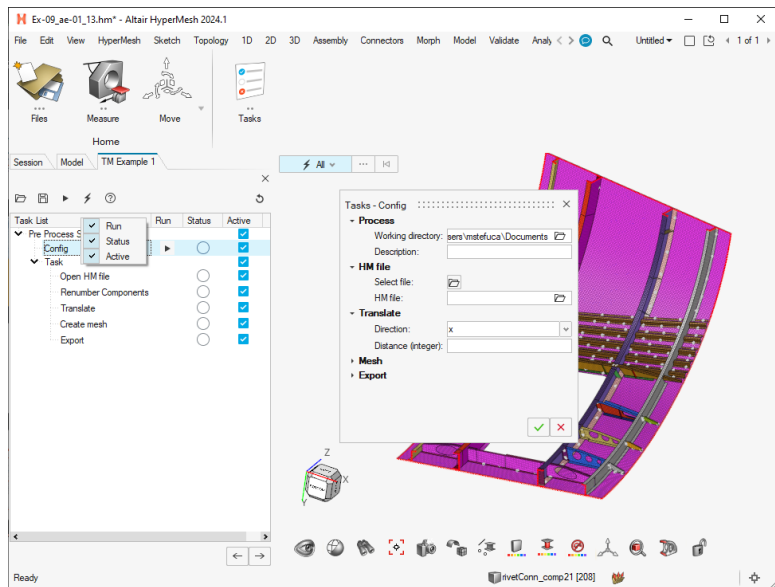
- 自从HW2024添加，支持HyperMesh和Python API，通过XML文件配置 workflows，做为对Process Manager的替代，同时弃用Process Manager
- 从Ribbon Developer进入并启动

XML file defining the process "Pre Process SETGET" and its individual tasks

```

1 <root>
2   <process label="Pre Process SETGET">
3     tag="preprocess"
4     title="TM Example 1"
5     saveonclose="False"
6     helpdocument="tmexample1HELP.pdf"
7     eeposition="undocked"
8     processloadprecommand="task_tmexample1_setget.preload(%S, %P)"
9     processloadpostcommand="task_tmexample1_setget.postload(%S, %P)"
10    sessionsavepostcommand="task_tmexample1_setget.postsave(%S, %P)"
11    sessionsaveprecommand="task_tmexample1_setget.presave(%S, %P)"
12    <task label="Config">
13      tag="config"
14      command="task_tmexample1_setget.applyConfig()"
15      applybuttonstate="Enabled"
16      <category tag="Cat_process" label="Process">
17        <property label="Working directory">
18          tag="workingdir"
19          displaytype="choosedir"
20          getcommand="task_tmexample1_setget.getWorkDirectory()"
21          setcommand="task_tmexample1_setget.setWorkDirectory(%V)" />
22        <property label="Description">
23          tag="description"
24          displaytype="string"
25          help="Max number of characters: 25"
26          validatecommand="task_tmexample1_setget.validateDescription"
27          setcommand="task_tmexample1_setget.setValue(description, %V"
28          getcommand="task_tmexample1_setget.getValue(description)" />
29        </category>
30        <category tag="config_hm" label="HM file">
31          <property label="Select file">
32            tag="btn_selectfiles"
33            help="custom image"
34            displaytype="actionbutton"
35            image="toolbarFileOpenStrip-16.png"
36            setcommand="task_tmexample1_setget.selectHMFiles()" />

```



Edit Process

Column Visibility

Items

process

task

category

task

category

property

property

task

task

task

task

Valid

tag

label

help

displaytype

command

precommand

postcommand

process

task

category

task

category

property

property

task

task

task

task

preprocess

config

cat_tasks

import_hm

task_cat_hm

btn_hm_select

task_hmfile

renumber

translate

mesh

export

Pre Process S...

Config

Task

Open HM file

HM file

Select file

HM file

Renumber Co...

Translate

Create mesh

Export

select hm file ...

Select an HM f... fileopen

Renumber all ...

Mesh selecte...

task_tmexamp...

task_tmexamp... task_tmexamp... task_tmexamp...

task_tmexamp...

task_tmexamp...

task_tmexamp...

task_tmexamp...

actionbutton

Name

Value

tag:

label:

help:

displaytype:

visible:

enabled:

value:

validatecommand:

getcommand:

setcommand:

valuelist:

getvaluelistcommand:

followupdatecommand:

image:

task_hmfile

HM file

Select an HM file

fileopen

☒

☒

task_tmexample1_setget.getVal...

task_tmexample1_setget.setValu...

task_tmexample1_setget.getHM...

Select File

Modules: 1

actions

C:\WORK\DevBuilds\2024.1.0.16-99381\hwdesktop\demos\sd\k\task_manager\Task_Manager_Example1\tools\actions.py

importOneHmFile(hmFile)

renumberComps()

translateAll(direction, distance)

setSurfColToMesh(surfCol)

mesh(meshSize)

exportfile(filepath)

Add as:

getcommand

setcommand

getvaluelistcommand

followupdatecommand

validatecommand

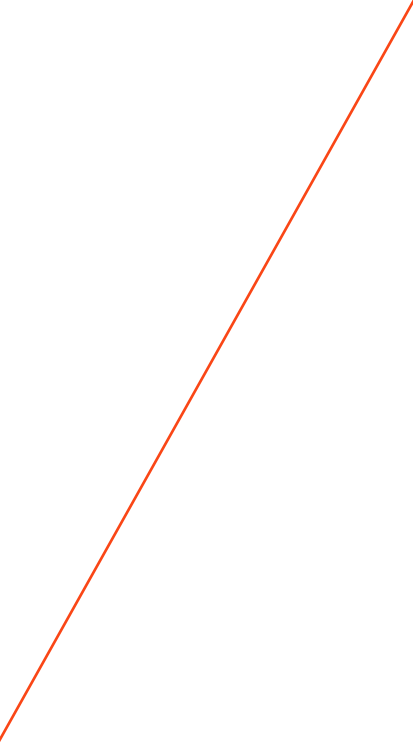
Close

Python 函数查看区

规范化建模流程定制开发

从Tcl开发到Python开发的转换

Tcl	Python
自定义框架，组织代码	Extension
Tcl 代码库	Python 代码库
GUI: hwtk	GUI: hwx.gui
Tcl API: 开发功能	Python API: 开发功能



THANK YOU

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#ONLYFORWARD