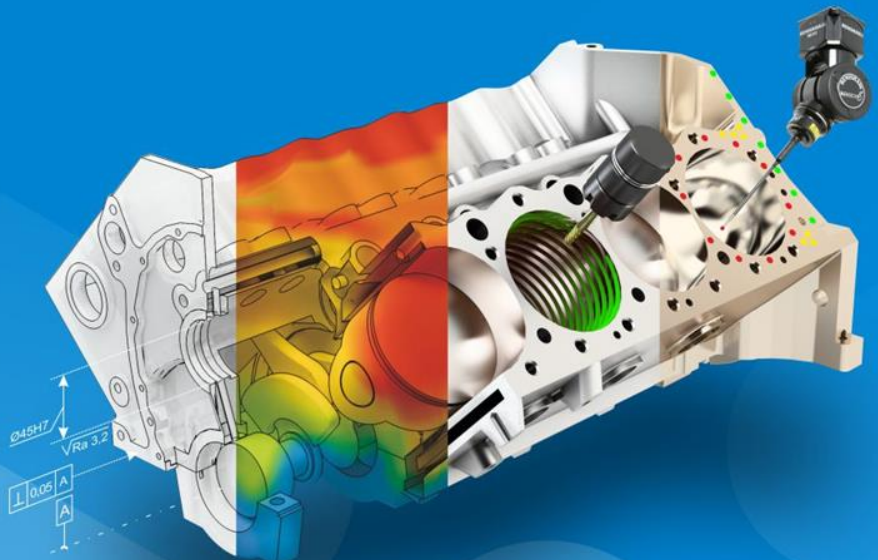
Computer engineering
technologies

PLM URAL

CFturbo Add-on v1.0



Kirill Pestov

kp@plm-ural.ru

CFturbo Add-on – Overview

- **Name of the app: CFturbo Add-on**
- **Target application: Workflow**
- **Description: Integrates CFturbo and TurboGrid to provide parametric study of pump impeller in Workbench.**

The version of the App and the supported versions of ANSYS are the ones indicated on the App Store.

ACT App Store

- *https://appstore.ansys.com/shop/ACTApps_act%20apps*
- **Great place to get started**
  - A library of helpful applications available to any ANSYS customer
  - New apps added regularly
  - Applications made available in either binary format (.wbex file) or binary plus scripted format (Python and XML files)
  - Scripted extensions are great examples
  - Documentation and training materials available on the ANSYS Customer Portal: https://support.ansys.com/AnsysCustomerPortal/en_us/Downloads/ACT+Resources

Information

Welcome to the
ANSYS App Store

Please pay attention to paragraph 9 of the CLICKWRAP SOFTWARE LICENSE AGREEMENT FOR ACS EXTENSIONS regarding TECHNICAL ENHANCEMENTS AND CUSTOMER SUPPORT (TECS): “TECS is not included with the Program(s)”

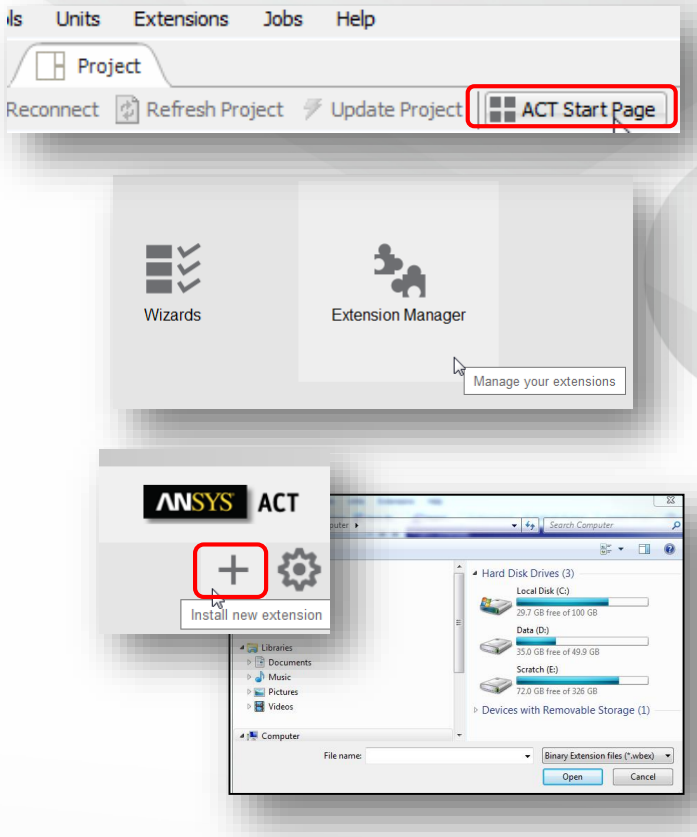
Report any issue or provide feedback related to this app please contact:

kp@plm-ural.ru

Binary App Installation (1)

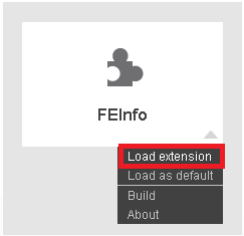
Installing from the ACT Start Page:

1. From the project page, select the "*ACT Start Page*" option
2. Click on "Extension Manager"
3. Press "+" symbol in the top right corner
4. It will open a file dialog to select the appropriate "**.wbex*" binary file
5. The extension is installed



Loading the extension:

1. From the Extension Manager, click on your extension and choose 'Load Extension'
2. The extension is loaded



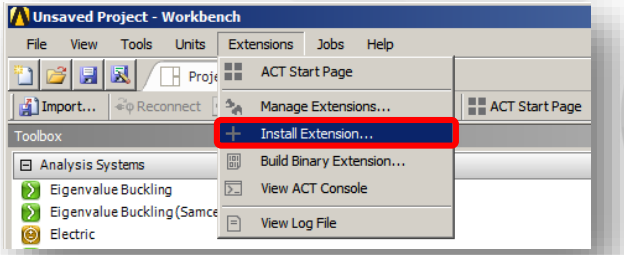
Notes:

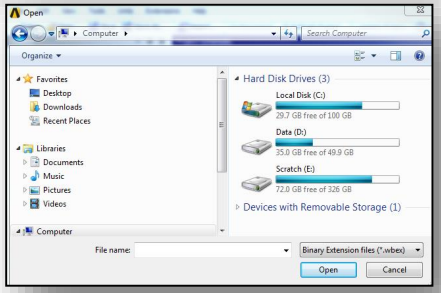
- The extension to be installed will be stored in the following location: %AppData%\Ansys\[version]\ACT\extensions
- The installation will create a folder in this location, in addition to the .wbex file
- Example for [version]: v180

Binary App Installation (2)

Installing from the Extensions menu:

1. From the Extensions menu, select the "*Install Extension…*" option
2. It will open a file dialog to select the appropriate "**.wbex*" binary file
3. Click "Open" to install the extension





Loading the extension:

1. From the Extension Manager, click on your extension and choose 'Load Extension'
2. The extension is loaded

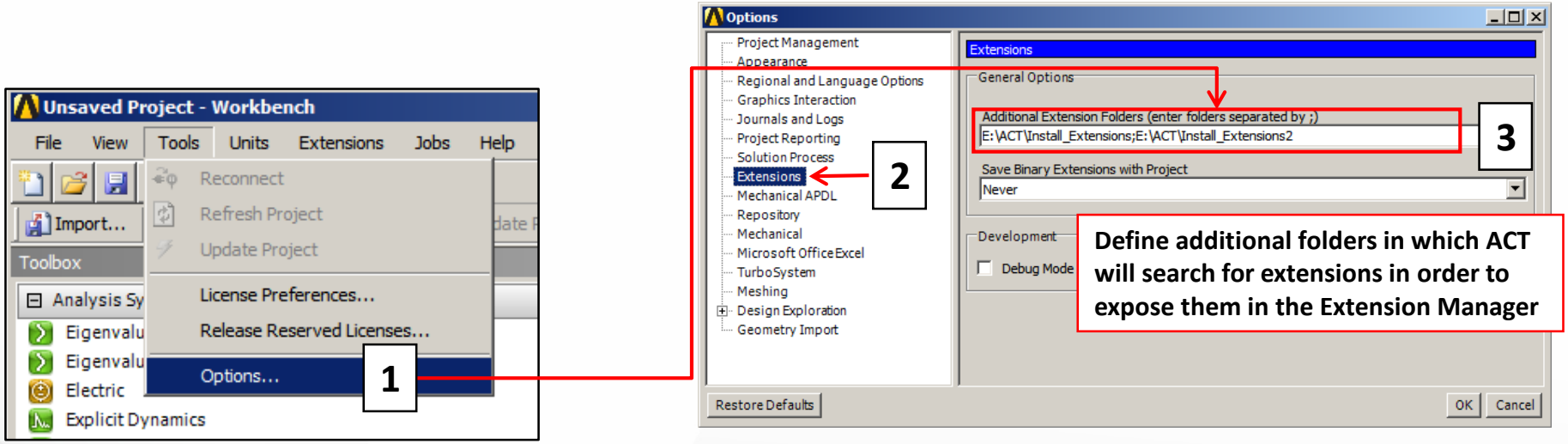
Notes:

- The extension to be installed will be stored in the following location: %AppData%\Ansys\[version]\ACT\extensions
- The installation will create a folder in this location, in addition to the .wbex file

Binary App Installation (3)

- **Once the binary extension is installed at default location, one can move the *.wbex and the folder to any other location**
  - **Default path: *%AppData%\Ansys\[version]\ACT\extensions***
  - **New path: Any location on your machine, shared drive etc.**

- **All users interested in using the extension need to include that path in their Workbench Options**
  1. **In the *"Tools"* menu, select the *"Options…"***
  2. **Select *"Extensions"* in the pop up panel**
  3. **Add the path under *"Additional Extensions Folder …"***



Notes:

• During the scan of the available extensions, the folders will be analyzed according to the following order:

1. The application data folder(e.g. *%AppData%\Ansys\[version]\ACT\extensions)*
2. The additional folders defined in the "Additional Extension Folders" property
3. The installation folder
4. The "extensions" folder part of the current Workbench project (if the project was previously saved with the extension)

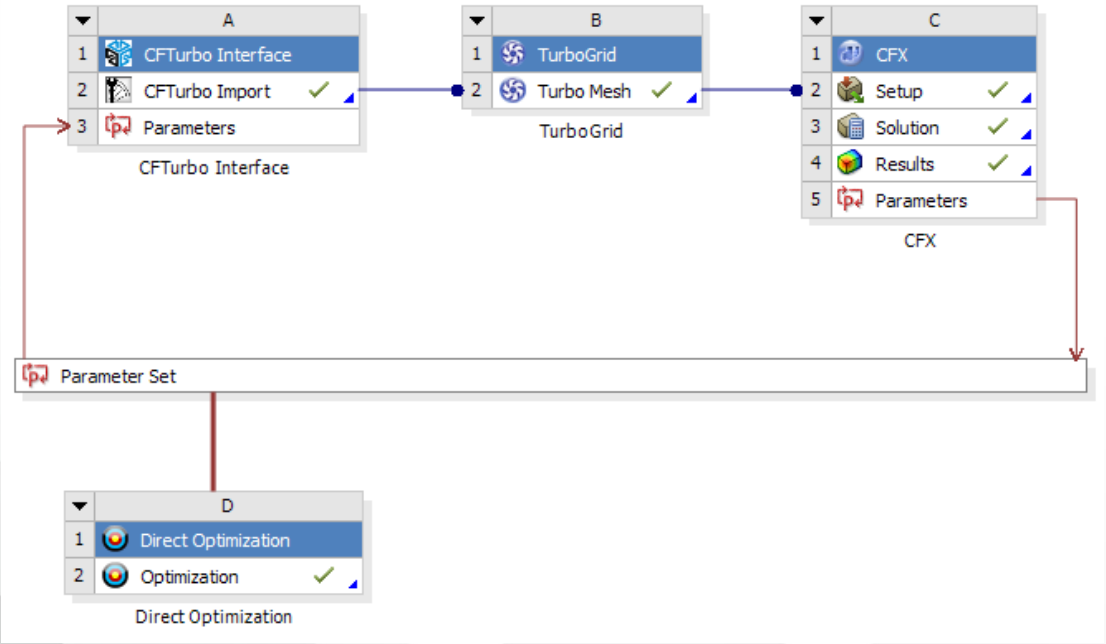
• If an extension is available in more than one of these locations, the 1st one according to the scan order is used

Documentation (about 1)

PLM URAL

CFturbo Add-on transfers geometric parameters of a pump impeller to ANSYS Workbench and passes geometry of impeller to TurboGrid.

It is compatible with DesignXplorer to perform an automatic optimization of a pump impeller.



Workbench project schematic

10	CFTurbo batch input file	
11	Input File Name	C:\ansys_projects\act\kp\pump_optimization_files\dp0\CFT-2\ACT\my_pump_ini.cft-batch
12	Main dimensions of Impeller	
13	Hub diameter	0,025
14	Suction diameter	0,15
15	Impeller diameter	0,18
16	Impeller outlet width	0,035
17	Blade properties	
18	Number of blades	6
19	Thickness leading edge at hub	0,0026
20	Thickness leading edge at shroud	0,0026
21	Thickness trailing edge at hub	0,003
22	Thickness trailing edge at shroud	0,003
23	Blade angle leading edge at hub	47,3
24	Blade angle leading edge at shroud	18,7
25	Blade angle trailing edge at hub	27,1
26	Blade angle trailing edge at shroud	32
27	Blade mean lines	
28	Leading edge angle	0
29	Trailing edge angle	70
30	Meridional contour	
31	Leading edge position at hub [relative]	0,31752
32	Leading edge position at shroud [relative]	0,25
33	Blade profiles	
34	Distance to pressure side at hub (point 1)	0,00134
35	Distance to pressure side at Shroud (point 1)	0,00134
36	Distance to pressure side at hub (point 2)	0,00138
37	Distance to pressure side at Shroud (point 2)	0,00138
38	Distance to pressure side at hub (point 3)	0,00142
39	Distance to pressure side at Shroud (point 3)	0,00142
40	Distance to pressure side at hub (point 4)	0,00146
41	Distance to pressure side at Shroud (point 4)	0,00146

Big amount of pump impeller parameters

Documentation (about 2)

PLM URAL

Automatic update of a pump impeller geometry during optimization.

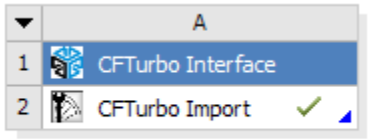
Parameterization capabilities:

- **Suction diameter**
- **Impeller diameter**
- **Outlet width**
- **Number of blades**
- **Wrap angle for main blade and splitter**
- **etc …**

..cft-batch - .xml like file

axial_pump_10_3.cft-batch

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<CFturboFile Version="10.3">
  <CFturboBatchProject InputFile=".\axial_pump_10_3.cft">
    <Updates>
      <CFturboProject Type="Object" Version="10.3">
        <CFturboDesign_AxialImpeller Type="Object" Name="Axial Impeller" Info="PLM Ural (2/4/84)">
          <MainDimensions Type="Object">
            <MainDimensionsElement Type="Object" Name="Version 1.">
              <dN Type="Float" Caption="Hub diameter" Desc="Inner diameter at inlet side">0.22</dN>
              <dS Type="Float" Caption="Suction diameter" Desc="Outer diameter at inlet side">0.48</dS>
              <dH2 Type="Float" Caption="Hub diameter outlet" Desc="Inner diameter at outlet side">0.25</dH2>
              <dS2 Type="Float" Caption="Tip diameter outlet" Desc="Outer diameter at outlet side">0.48</dS2>
            </MainDimensionsElement>
          </MainDimensions>
          <Meridian Type="Object">
            <HUB_CtrlPntList Count="2" Type="Array1" Caption="Hub Contour Controls" Desc="Contains all editable control points of this contour.">
              <Value Type="Vector2" Index="0">
                <x Type="Float">0</x>
                <y Type="Float">0.11</y>
              </Value>
```



CFTurbo Interface

12	Main dimensions of Impeller		
13	Hub diameter	0,22	☑
14	Suction diameter	0,48	☐
15	Hub diameter outlet	0,25	☐
16	Tip diameter outlet	0,48	☐
17	Blade properties		
18	Number of blades	7	☐
19	Thickness leading edge at hub	0,012	☐
20	Thickness leading edge at shroud	0,012	☐
21	Thickness trailing edge at hub	0,008	☐
22	Thickness trailing edge at shroud	0,008	☐
23	Blade angle leading edge at hub	37,3	☐
24	Blade angle leading edge at shroud	37,3	☐
25	Blade angle trailing edge at hub	60	☐
26	Blade angle trailing edge at shroud	60	☐
27	Blade mean lines		
28	Leading edge angle	0	☐
29	Trailing edge angle	55	☐

Pump impeller parameters

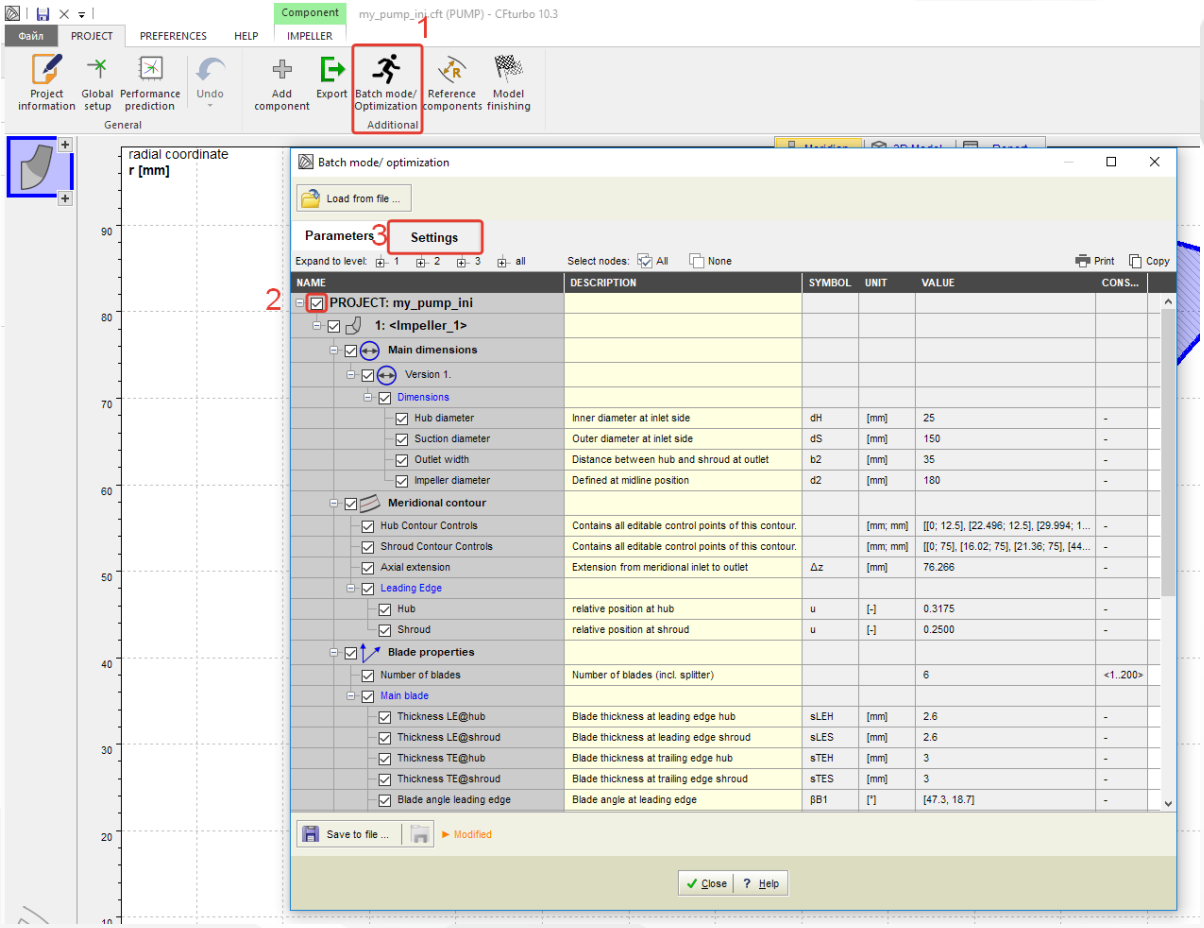
Documentation (CFturbo setup 1)

- **In CFturbo after saving your final geometry of an impeller (.cft):**

1. Click the Batch mode / Optimization in the main menu.

2. Choose all the parameters in a parameters' tree.

3. Click the tab Settings.



Documentation (CFturbo setup 2)

- **In CFturbo after saving your final geometry of an impeller (.cft):**

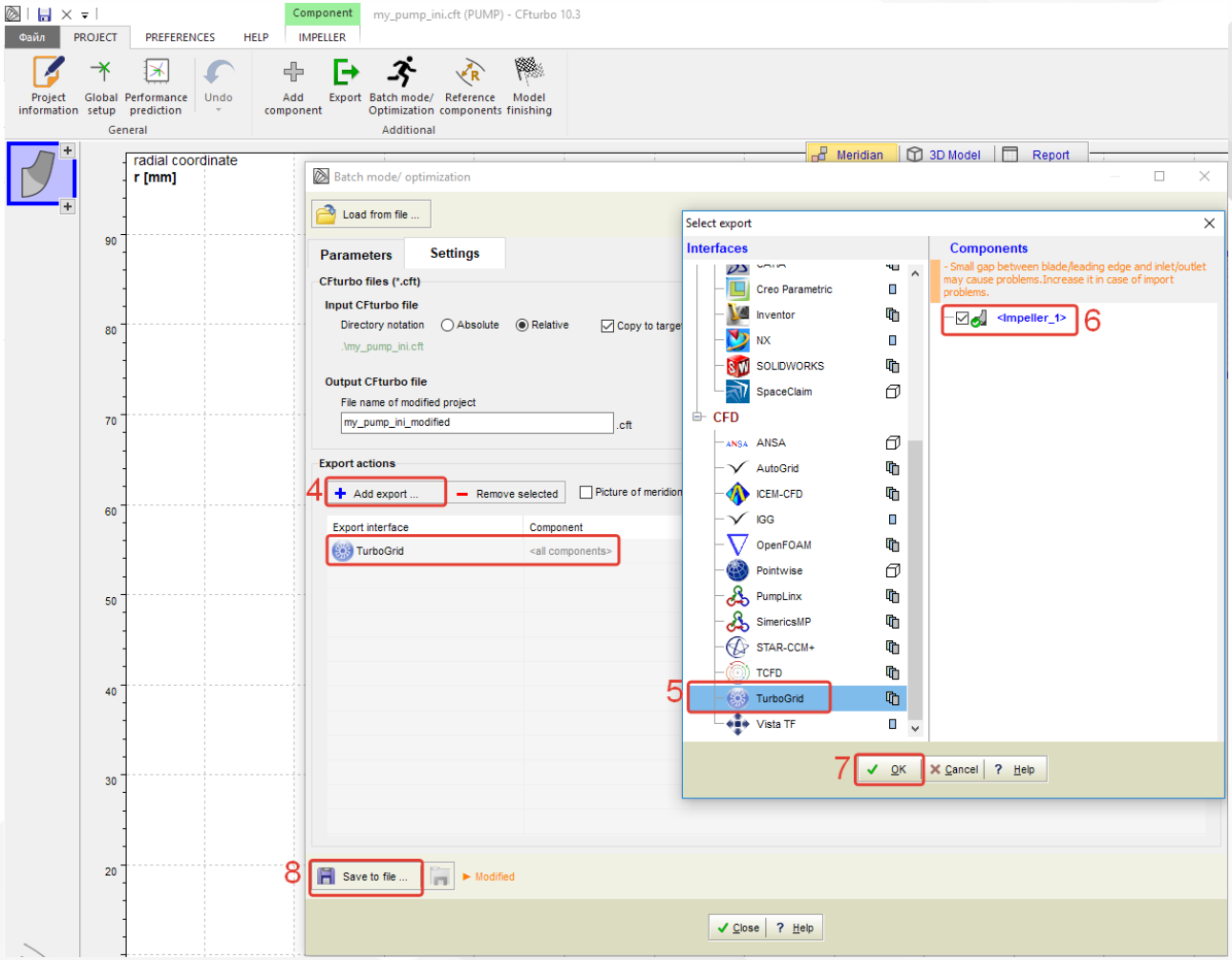
4. Click the Add export …

5. In an opened panel “Select Export” choose TurboGrid.

6. Select Impeller component.

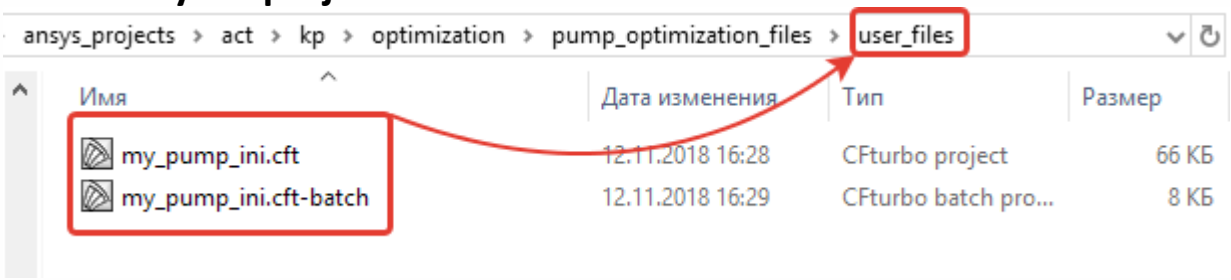
7. Click OK.

8. Save .cft-batch file in your working directory.

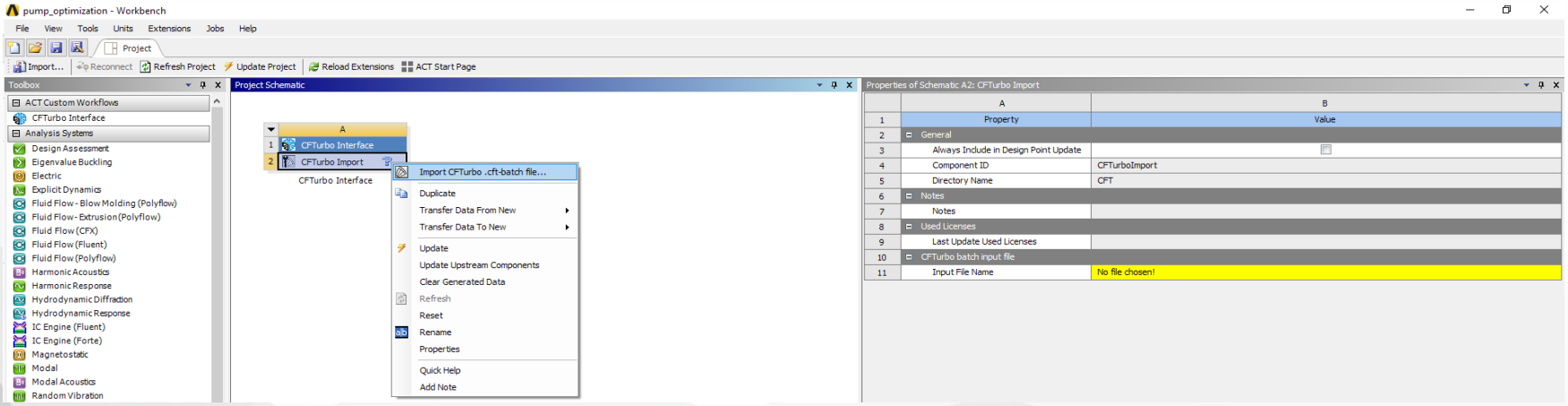


Documentation (project setup 1)

- **Create a new Workbench project and place .cft and .cft-batch files from CFturbo to user_files folder of your project.**

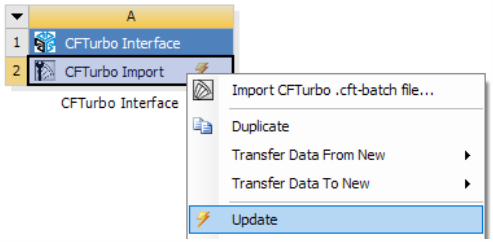


- **Drag and drop ACT to the project schematic and switch on visibility of properties via main menu (View > Properties).**
- **Click RMB on CFturbo Import cell and select Import CFturbo .cft-batch file… in a drop down menu.**

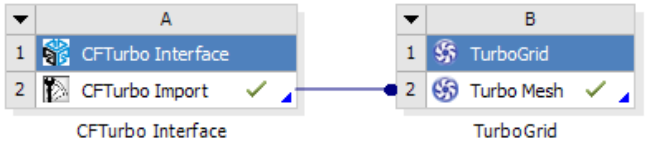


Documentation (project setup 1)

- **Select .cft-batch file from user_files folder and click OK. After loading .cft-batch file into ACT system you can see a table of impeller parameters from the right side in a cell properties panel.**
- **Click RMB on CFturbo Import cell and choose Update to complete load of geometric parameters.**

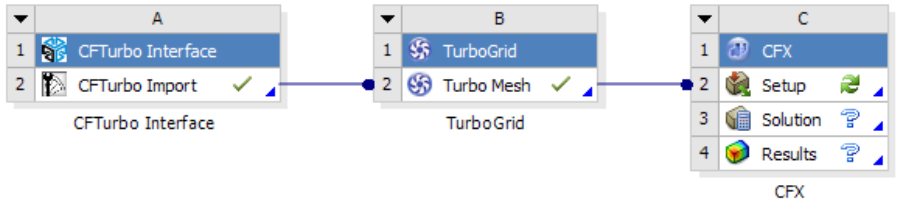


- **Link CFturbo Interface system to a new TurboGrid system.**



Documentation (project setup 2)

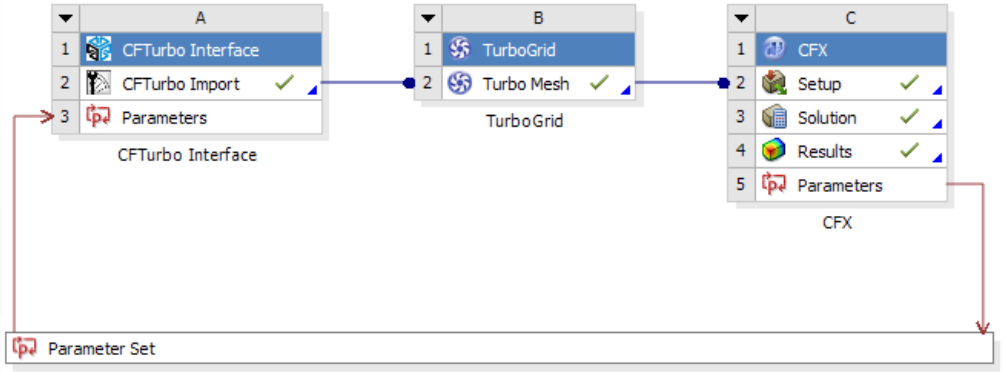
- **Link a TurboGrid to CFX or Fluent System.**



- **Define your model and start a parametric study.**

Table of Design Points

	A	B	C	D	E	F	G
1	Name	P1 - beta2s	P2 - beta2h	P3 - head	Retain	Retained Data	Note
2	Units			m			
3	DP 0 (Current)	32	27,1	14,556	☑	✓	
4	DP 1	34	40	⚡	☑	⚡	
*					☐		



Know Issues and Limitations

- **ACT can transfer only geometry of a pump impeller! Other machine types are not supported.**
- **Supported version of CFturbo: 10.3.x.**
- **You can define maximum 4 control points in CFturbo to parametrize distance to the pressure side.**

33	Blade profiles		
34	Distance to pressure side at hub (point 1)	0,00134	
35	Distance to pressure side at Shroud (point 1)	0,00134	
36	Distance to pressure side at hub (point 2)	0,00138	
37	Distance to pressure side at Shroud (point 2)	0,00138	
38	Distance to pressure side at hub (point 3)	0,00142	
39	Distance to pressure side at Shroud (point 3)	0,00142	
40	Distance to pressure side at hub (point 4)	0,00146	
41	Distance to pressure side at Shroud (point 4)	0,00146	

Thank you

Join the ACT Group on LinkedIn:

"Customization ACTors for Engineering Simulation"

- **PLM Ural**
- **Kirill Pestov**
- **kp@plm-ural.ru**

PLM URAL