The Model Processing Research in PRO/E and ADAMS Co-simulation

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Abstract. This paper discusses the specific methods of operation and some skills when the model is imported from PRO/E to ADAMS. Meanwhile a basic principle is pointed out. That is the parts involved in moving should be finished in ADAMS as much as possible, the parts that do not participate in moving with high appearance requirements as much as possible are modeled in PRO/E. The methods, principles and techniques of this paper have guiding significance in practice for the engineers.

1. Introduction
As is known, ADAMS is a software which can simulate to kinematics and dynamics of mechanical systems, which is characterized by rapidly building complex mechanical system virtual prototype model of the product before the actual production would not be produced, to know in advance the various properties of the product, to prevent the presence of various design flaws, to suggest improvements. Because the motion parameters ADAMS of the simulation are giant and more, if the shell structure of the system model, especially the movement has nothing to do with the exterior design is very complicated structure built in ADAMS, will affect its speed of operation and effect, so ADAMS for model Overall structure is simplified as a rigid body, and does not require too much shape designs. So ADAMS software itself cannot provide enough modeling tools, which is the inadequate of ADAMS. However, ADAMS provides an application interface technology, that can import PRO/E and other three-dimensional CAD software model. This feature greatly enriches and improves efficiency for ADAMS, and makes the overall models look more beautiful. This paper explores some issues which are related to model processing in co-simulation of PRO/E and ADAMS by applied examples, which can give engineers some useful reference in practical applications.

2. The Procedure of Importing Part Model from PRO/E to ADAMS in Co-simulation
When doing the co-simulation by PRO/E and ADAMS, PRO/E model should be firstly saved as a suffix X_T format.

Here use a cylindrical gear from PRO/E to ADAMS as an example to explain the import of a single model. After complete the modeling gear in PRO/E, click the main menu "File" - "Save a copy of the", pop-up a dialog box. In the "Type" drop-down menu "Parasolid (*.x_t.)", click OK. Again pop up a dialog box and click OK again. if PRO/E working directory now has a document named x_t suffix, it shows the success of exporting the model. At the same time, please make sure that the directory of saving *. catalog_x_t document cannot contain Chinese characters, otherwise there will be error when import it into ADAMS. Next, open ADAMS / VIEW, click “file” - “import”, the pop-up dialog box as shown in Figure 1.

Then click on the “File Type” drop down menu to find the Para-solid (*. Xmt_txt, *. X_t .......) , the option as shown in Figure 2, after that the interface becomes Figure 3. In an empty space of the file to
click on the right mouse button, click Browse, find the file you just saved *.x_t , if here it is separate to the * .x_t copy files from other computers, please note that the path name cannot contain Chinese characters. Then click the model name drop-down menu, click the Part Name, to rename parts which will be imported in ADAMS, as shown in Figure 4. Then click OK. The original ADAMS model has a rack, so now the importing gear as shown in Figure 5. However, the position of the model required that as shown in Figure 6.

When the import is successful, the first thing is to set the material properties to the part, otherwise it cannot be used in motion-simulation. First left-click to select the gear, then right-click, the options pop-up as shown in Figure 7, click the Part: zhichilun, pop-up a dialog box as shown in Figure 8. Now its mass here is 0. Then click Define Mass by drop-down menu, select Geometry and Material Type as shown in Figure 9. Right-click on the back of the Material Type, as shown in Figure 10, then select the Material-Browse, to pop Figure 11, select the appropriate material steel, then click OK, to complete the import working model. Next, to adjust the relative position of the model relative to the previous model. Click on the main menu EDIT-MOVE, the pop-up a dialog box as shown in Figure 12, respectively click TRANSLATE following X / Y / Z, so that the gear along the X / Y / Z axis moving to the correct location. As shown in Figure 6. When the relative position is correct between the components, it can add constraints and driving, then do the motion-simulation.

If the part is invisible, maybe the part and background have the same color. Please change background color of ADAMS. If modify the color of some parts which have been successfully imported from PRO/E, select the part, then right-click the pop-up dialog box as shown in Figure 7, but please select SOLID-SOLID1-SELECT in Figure 7, then click the color button.
Figure 5.

Figure 6.

Figure 7.

Figure 8.

Figure 9.

Figure 10.
3. The Basic Principle of Co-simulation by PRO/E and ADAMS: The Main Moving Parts Should be Modeled in ADAMS, Non-moving part or the High Requirements for Parts Shape Should be Modeled in PRO/E.

ADAMS/VIEW provides data exchange interfaces such as Parasolid, STEP, IGES, SAT, DXF and DWG and so on, due to existing 3D CAD software basically provide these data interfaces, so the transition from three-dimensional CAD to ADAMS / VIEW is not difficult. One of the Shortcomings is the model transformed from the PRO/E or other CAD software can not be parameterized, can not be modified by the geometry component. If modify the geometry, please return to the three-dimensional
CAD software. After finish modifying, transform it to ADAMS. The models imported from PRO/E and other CAD software has no property characteristics. In another word, it doesn't have mass. Please modify their quality property characteristics after import it one by one. If there are too many solids, it will be too complexed. So in the modeling process before doing mechanical motion simulation system, the main moving parts as much as possible should be modeled in ADAMS, that will be easy to follow the motion simulation or modify part dimensions and other operations. Only such as surfaces, such as modeling, or exterior design requirements for high structure such as spline surfaces, or non-moving parts, can be completed in PRO/E, and then are imported into the ADAMS.

4. The Method of Transforming the Assembly Model from PRO/E into ADAMS
There take the model of the rapeseed sun cutting machine as an example. The modeling and assembly work has completed in PRO/E as shown Figure 13. Then follow the operation as above converting it to X_T extension file for later use. Then import the model into ADAMS. Firstly click FILE-IMPORT, pop-up a dialog box as shown Figure 1, in order to select as Figure 2, click MODEL NAME dialog box in Figure 3, and enter the new model name shaigeji, finally imported model is as shown in Figure 14. Next, the material properties of each part should be modified as Figure 7 to Figure 11 steply. Finally, add joints and driving and simulate the model.

5. In Order to Add Joints and Drives in ADAMS, the Non-moving Parts Is Recommend to by Fixed by Each Other, or to Be connected Together by Boolean Operation
A lot of parts in the model of the rapeseed sun cutting machine have been dealt before the simulation. The adjacent parts which don't moving will firstly be connected into a whole by boolean operation, such as body. For the non-adjacent parts which don't move will be fixed to each other by FIX joint. Next use APPEARANCE provided by ADAMS to hide them. Finally, all the moving parts appears, and then add constraints obviously.

Figure 13.
6. Summary
This paper discusses the specific methods of operation and some skills when the model is imported from PRO/E to ADAMS. The methods, principles and techniques in this paper can be guiding significance in practice for the engineers.

7. Reference
[1] Zenggang Li, C.: An introduction and example for ADAMS (in Chinese). National Defense Industry Press, Beijing, China (2014)
Renxi Hu, C.: Virtual prototyping technology from entry to mastery (in Chinese). Machinery Industry Press, Beijing, China (2016)
[2] Xurong Li, Xiangzhou Zheng, M.S.: ADAMS-enabled virtual prototyping and dynamic simulation approach into planing mechanism. In: Chinese Journal of Construction Machinery, Vol. 5 No. 4, Totally 504 P437-439 (2007)
[3] Xurong Li, Shouyi Zhang, C.: The Virtual Reality Simulation for the Unmanned Lunar Vehicle Based on ADAMS. In: The International Conference on Multimedia Technology totally 1242 P972-974 (2010)
[4] Xurong Li, Kundian Wang, C.: Virtual Prototype Design of Spherical Material Vibration Grader Machine Based on ADAMS. In: Advanced Research on Intelligent Systems and Mechanical Engineering 644 P271-274 (2013)
[5] Yao Fu, Xurong Li, C.: The Virtual Prototype Design of Boating Robot Based on ADAMS. In: Advances in Intelligent Systems Research (ISSN 1951-6851) Volume 142 P34-36. Atlantis Press, French (2017).