The using of Virtual Prototyping technology in education

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Virtual Prototyping technology is very important in new product development, and it’s a main trend for manufacturing industry. It’s necessary to open this kind of course for cultivating talents of multi-body dynamics. From teaching and test links the students’ product development ability based on multi-body dynamics platform can be increased. Very year there are about one thousand and two hundred students should partake this course learning. This course is divided in two parts of theoretical study and test link, and the curriculum setup is based on Recurdyn software. In this paper, some study methods, design examples, design idea and software are presented and an effective education procedure is discussed.

In this paper some samples can be provided such as chain, V-Bbelt Tutorial and MTT2D Tutorial with IGES Import virtual prototype. Some design procedures and methods can be offered based on Recurdyn software. as follows: create new models, set working condition, create design points, create all parts models, imposing forces and constraints, test model, refining model, iterating model, optimize model and customize interface. From the above design procedures, the virtual prototype can be gotten and has been optimized design analysis. From the design results of virtual prototype, physical model machine can be made. The above design procedures and methods can be applied for all kinds of virtual prototype design. From the above training, the students can have a kind of design concept, and this is very important for students to resolve some actual problems. The students can engage in researching and technology development work. When they go to operating post, they can bring these design ideas to their work and can increase working efficiency. The student is user of any new technology because of its special education background. So education methods and study condition are very crucial.

So the course of multi-body dynamics is very important for the students’ development and innovation of manufacturing industry.
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ABSTRACT  
Virtual Prototyping technology is very important in new product development, and it’s a main trend for manufacturing industry. It’s necessary to open this kind of course for cultivating talents of multi-body dynamics. From teaching and test links the students’ product development ability based on multi-body dynamics platform can be increased. Very year there are about one thousand and two hundred students should partake this course learning. This course is divided in two parts of theoretical study and test link, and the curriculum setup is based on Recurdyn software. In this paper, some study methods, design examples, design idea and software are presented and an effective education procedure is discussed.

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1. INTRODUCTION  
Mechanical specialized field of Jilin University is oriented to engineering plant, car and digital control processing fields to train talents. In recent years, with the development of CAE, Multi-Dynamics and united simulation, Virtual Prototyping technology has been paid close attention. Virtual Prototyping technology is very important in new product development, and it’s a main trend for manufacturing industry. It’s necessary to open this kind of course for cultivating talents of multi-body dynamics.

Virtual Prototyping technology course of Jilin University was built in the nineties of the twenty century, and the content includes Virtual Prototyping modeling, simulation calculated and optimization analysis. This course is built based on Automatic Dynamic Analysis of Mechanical System (ADAMS) software. With the development of finite element analysis technology and multi- Dynamics technology and Its united technology, RecurDyn technology have appeared. Korea FunctionBay company presented Jilin University with RecurDyn software on 25, January, 2009. This is very important for Jilin University to build Virtual Prototyping technology course and cultivate talents of multi-body dynamics. At the same time, This course based on RecurDyn software is also significant for Fountionbay company to popularize its RecurDyn technology, and more fields benefit a lot from RecurDyn technology.

2. BRIEF DESCRIPTION OF THE VIRTUAL PROTOTYPING TECHNOLOGY COURSE  
Very year there are about one thousand and two hundred students should partake this course learning. This course is divided into two parts of theoretical study and test link, and the curriculum setup is mainly based on Automatic RecurDyn software. Theoretical study is about 30 credit hours and test link is about 10 credit hours. From theory and test study, the students’ product development ability based on multi-body dynamics platform can be increased. It’s necessary to open this kind of course for
cultivating talents of multi-body dynamics. This course was based on ADAMS software before, and now because of FunctionBay company presenting Jilin University with RecurDyn software, this course is set based on RecurDyn software, and this learning is very important for students to open their ideas and fields. After they graduated from the college, this study experience of CAE, Multi-Dynamics and united simulation, Virtual Prototyping technology is very important for them to engage in manufacturing industry. They can also inject new ideas and conception into manufacturing field, and this can also decrease time between product concept design and actual product produced.

3. EXAMPLES BASED ON MULTI-BODY DYNAMICS SOFTWARE

During this course, some examples are exercised. Through these exercises, the students can master multi-body dynamics skills and use these skills to solve all kinds of actual engineering question and this is a way to improve the design methods.

The following are some examples and the thought and the process are provided.

3.1 Example 1: Chain Tutorial

This tutorial will help the student learn how to simulate the chain-drive of a forklift using the RecurDyn/Chain toolkit. The student can generate animations and plots, which will provide insight into the function of the model and verify the students’ intuitive understanding of the chain system. The completed chain forklift system is shown as following Figure 1.

The first step is getting started the RecurDyn software. The RecurDyn/Chain toolkit lets the students model chain and pulley systems of various types and configurations. In this tutorial the students will use Roller Links and Rollers. RecurDyn automatically creates the contacts between these entities when the students assemble the chain system. The students can also use other RecurDyn bodies, constraints, and force elements to model the chain systems. Once the chain subsystem is built, the students will combine it with an existing forklift model and run some simulations.

Before this exercise, the students should master 3D model knowledge.

The second step is creating the subsystem. using an existing base model, learn how to create a chain subsystem and bring the subsystem to approximately steady-state conditions. In the next chapter, the students will assemble the chain to the forklift and run a simulation.

The third step is simulate and extract the model. The students are now ready to simulate the model, bringing the chain ends into alignment with their connectors.

The fourth step is assembling the forklift. Make a copy of the chain subsystem created in the previous step and assemble it with the forklift model. Simulate the model and plot the results as following Figure 2.

3.2 Example 2: V-Belt Tutorial

This tutorial will help the students learn how to simulate the V-belt mowing system of a riding lawn mower using the RecurDyn Belt toolkit. The students will generate animations and plots, which will provide insight into the function of the model and verify the students’ intuitive understanding of the belt system. The completed V-belt mowing system is shown as following Figure 3.

The first step is getting started the RecurDyn software. The RecurDyn Belt toolkit lets the students model belt and pulley systems of various types and configurations. Some of the geometric entities in the toolkit that the students will use in this tutorial include: V-belt, Roller, Flange and V-pulley.

RecurDyn automatically creates the contacts between these entities and the belt segments when you assemble the belt system. You can also use other RecurDyn bodies, constraints, and force elements to model the belt systems.

The second step is creating the subsystem. Learn how to set up the simulation environment, create a subsystem of a belt, and import the geometry for the base plates (mower deck and motor mount) of the belt system.

The third step is creating the geometric entities. In this chapter, you will create the geometric entities that guide the V-belt: V-pulley, Roller, Flange.

The fourth step is assembling the belt. In this step, the students will create the belt and assemble the geometric entities that created in the previous step. The students will then run a simulation of the subsystem as following Figure 4. Looking at the results of the simulation, notice that there is a significant design flaw with this mower. The belt is unable to stay in place on the tensioner roller because there are no flanges to hold it there.

The fifth step is refining the model. In this step the students will modify the roller so it has appropriate flanges.

3.3 Example 3: MTT2D Tutorial with IGES Import

The purpose of this tutorial is to acquaint the students with the 2D Media Transport Toolkit (MTT2D) and how to simulate the behavior of paper traveling through rollers and guides. The students will learn how to import an IGES file and use the imported geometry to define an MTT2D model. It is not unusual for one engineer to design the paper path and for another engineer to do the simulation. The initial
paper path design is often considered from the side view as a 2D configuration and it can be represented as 2D lines and arcs in an IGES file. This is the case for this tutorial; the paper path is provided for the students in an IGES file and the students’ responsibility is to perform the simulation. As part of the simulation you will define guides on a body and control roller motion using an event sensor. An event sensor corresponds to a photoelectric cell (or the functional equivalent) that can be used to detect the entrance of the leading edge of the paper into the paper path or the departure of the trailing edge from the paper path.

The students will create the media transport model shown as following Figure 5. Note that while this example considers the simulation of paper, the media sheet could correspond to a film or any other flexible media.

The first step is Getting Started the Recurdyn software and setting up the simulation environment During this step, the students should learn how to set up the simulation environment, including units, materials, gravity, and the working plane. Find out how to create a media transport subsystem (2-D).

The second step is creating geometry. The students will create new geometry and manage the IGES geometry that has been imported to create an MTT2D model.

The third step is adding logic. In this step, the students will add a sensor and the controlling logic to the mechanism so that the paper reverses direction once the trailing edge has passed the scan line.

The fourth step is running simulation and plotting results. Learn how to run a simulation of the media transport model and plot the contact forces of several of the arc and linear guides.

4. CONCLUSIONS

From the above examples study and operation, the students can build a train of thought to use knowledge for resolving actual question.

5. THE TRAIN

Apart from the virtual prototyping technology course, We also make some trains based on recurdyn software.

There are some pictures about the train as the Figure.6, Figure.7 and Figure.8.

During this train course, We use the actual examples about the engineering facing to Some engineers and technic ans, introduce the whole processes of the engineering probl ems. This train is very successful.

6. FIGURES

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Figure 3. V-BELT MOWING SYSTEM MODEL

Figure 4. V-BELT MOWING SYSTEM MODEL SIMULATION RESULT

Figure 5. MEDIA TRANSPORT MODEL

Figure 6. THE TRAIN PICTURE1

Figure 7. THE TRAIN PICTURE2

Figure 8. THE TRAIN PICTURE3

Figure 9. THE TRAIN PICTURE4
ACKNOWLEDGMENT
This style file and sample file are developed based on the data of FunctionBay, Inc.

REFERENCES
1. Help data of Recurdyn software