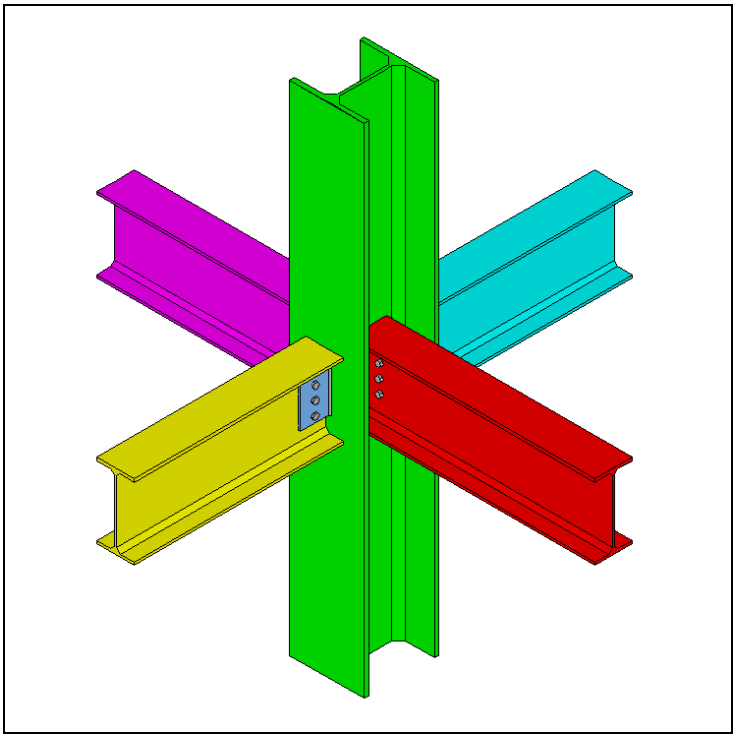
Paolo Rugarli

Connection Study Environment

Tutorial 7: Application of a parametric node



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1 INTRODUCTION

This tutorial is a tool to start the understanding of how CSE works. No special efforts to have realistic force values have been made, however this will explain several features of the program.

This tutorial will show how to apply a **parametric renode** (P-Renode) to a given renode. The application of a prenode leads to the automatic construction of a renode on the basis of the previously recorded construction of a similar node. This function is available in the LIGHT version and in the FULL one as well.

It is possible to apply a prenode to a renode if the renode is **empty** and if there is a **similar** prenode in the archive.

A renode is empty if there has not been any any addition of components, any modification or work process on the members, etc. After jnodes search, renodes are empty. If a renode has been modified, it can be turned back into an empty renode with the command **Reset renode content!** in the *Renode* menu (*Node* menu in the LIGHT version).

A prenode and a renode are similar if they have the same topology and the same cross-section kinds. For example, a node with an IPE200 horizontal beam connected to the flange of a HEB200 column is similar to a node with the same kind of connection but with an IPE270 beam and a HEM240 column. But if the column is a RHS shape or if the connection is on the web of a HEB shape, instead of its flange, the nodes are not similar.

N.B. this tutorial refers to CSE version reported on the first page of this document. If you are using a newer version, keep in mind that some dialog or commands may be different, although the logic of the program has remained the same. If you find some differences, see the up-to-date PDF guide or the context sensitive help for information.

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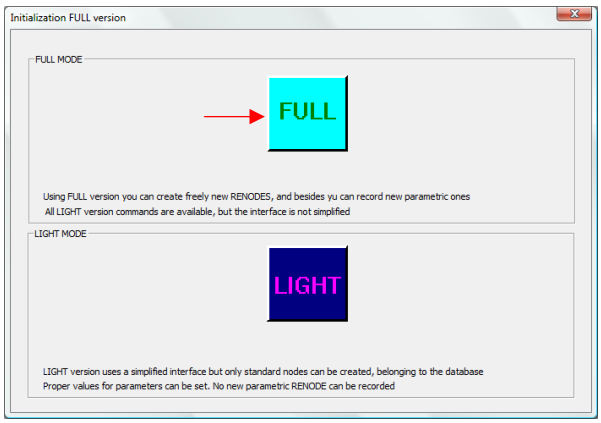
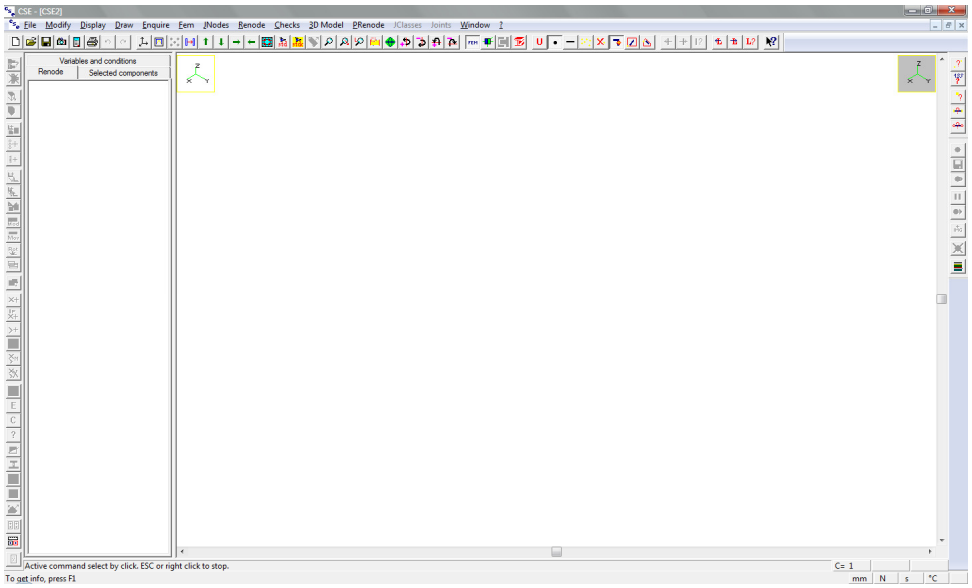
2 APPLYICATION OF A PARAMETRIC RENODE

2.1 PRELIMINAR: GETTING THE EMPTY RENODE

In order to make this tutorial a “stand alone” introductive guide to parametric renodes application, let’s start from a new model. If you already have a renode, skip to step 2.2.



In the initial dialog box, choose the full mode (complete, with no limitations). The same operations we are going to do could be done with the light version as well.



Initial window content: blank. Activate the graphical view by clicking it, then use the command

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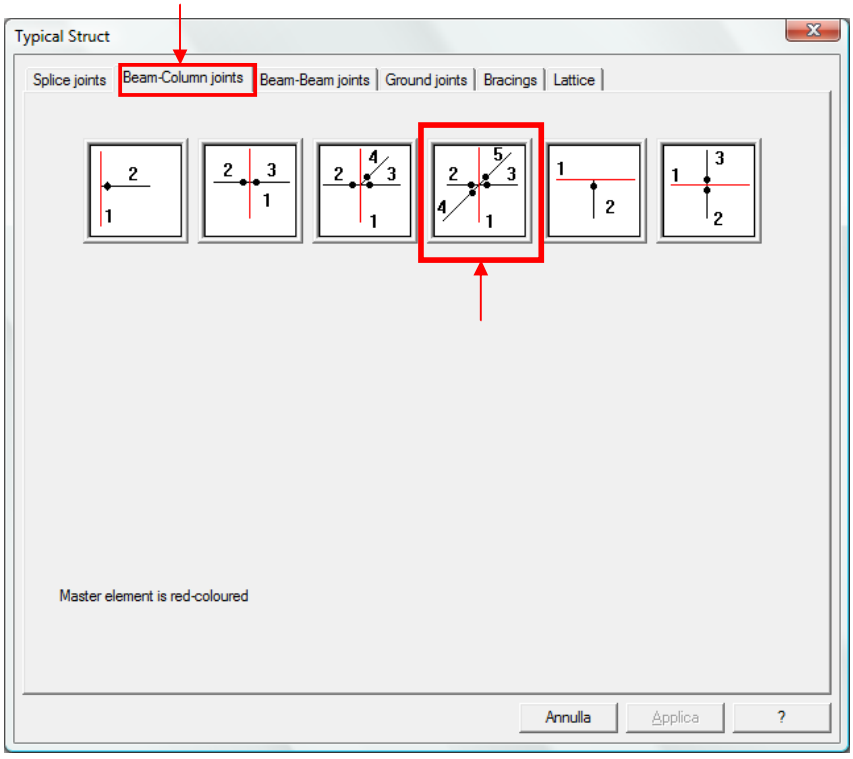
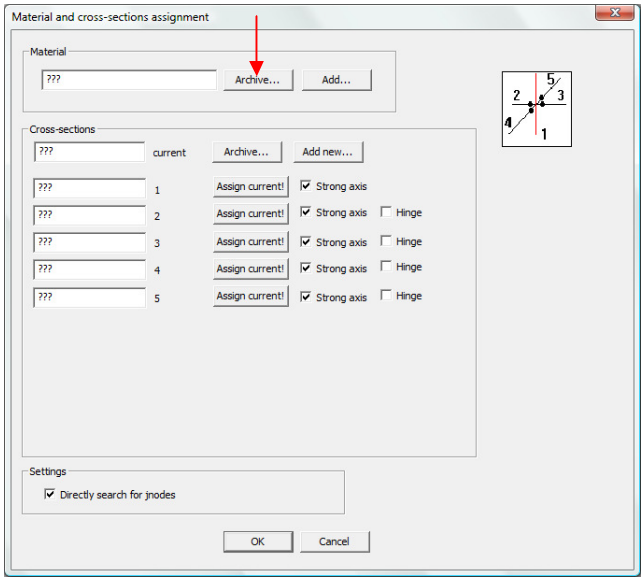
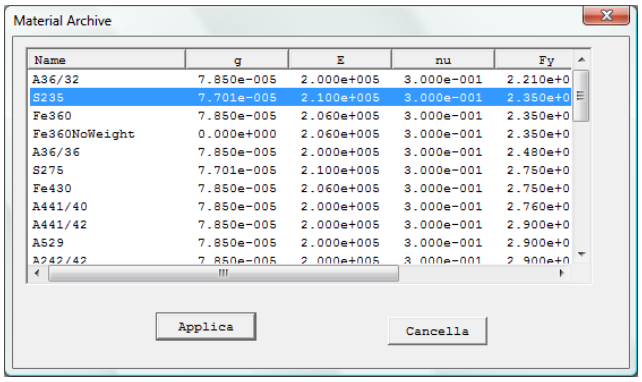
and choose the fourth structure in the “Beam-column joints” page.



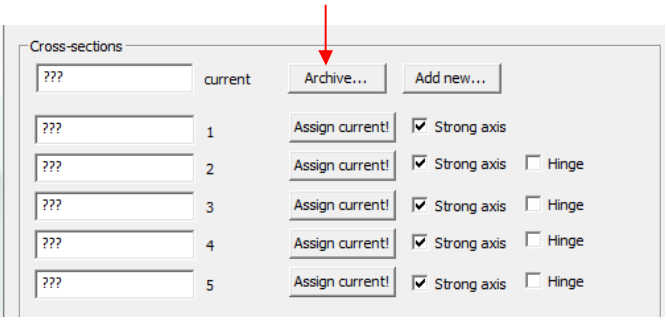
In the following dialog box, click “Archive” in the box called “Material”



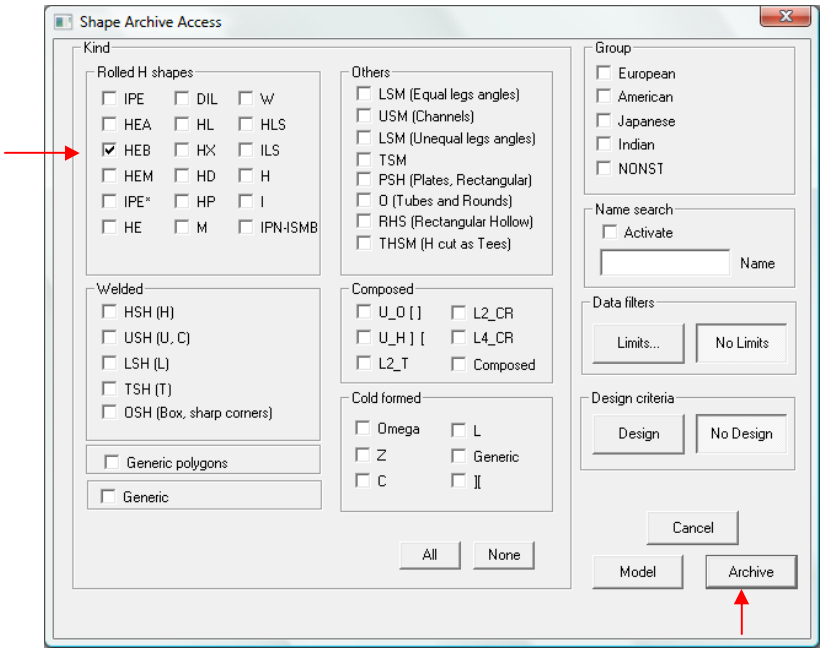
then select S235 from the archive and apply it.



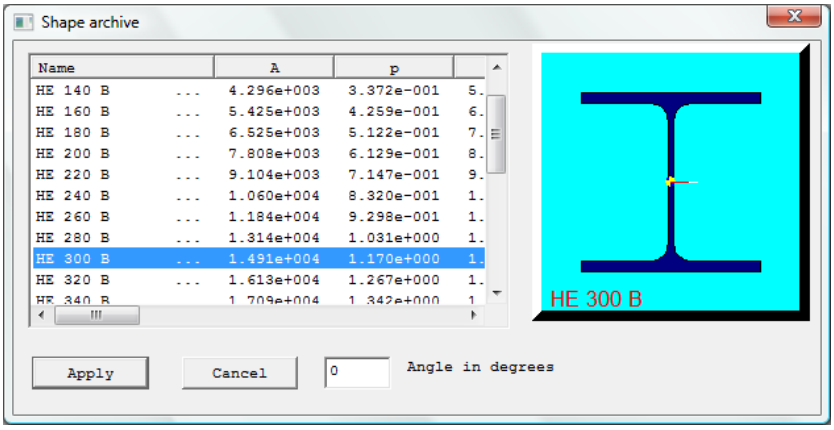
Back to main dialog box, click “Archive” in the box called “Cross-section”



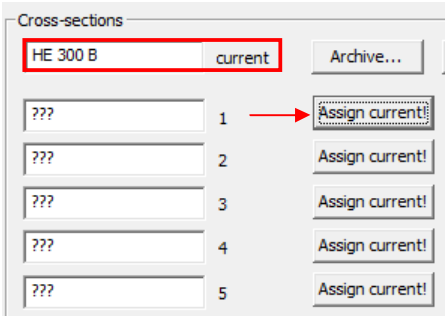
then tick HEB filter and press “Archive”.

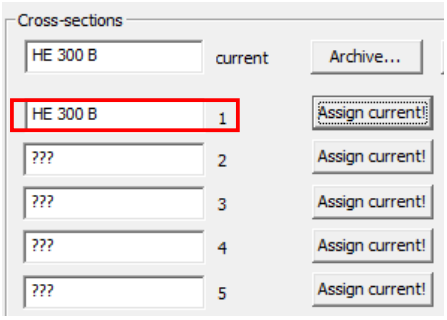


Choose HEB300 and apply it.

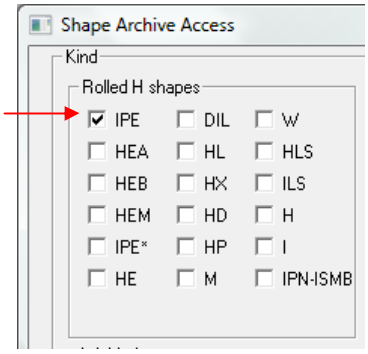


HEB300 is now the current section. Click the "Assign current!" button on member 1 row to assign current shape to member 1 (the master).





Click "Archive" button again, remove the tick from HEB shapes and tick IPE.



From the IPE archive, choose IPE270 and apply it.

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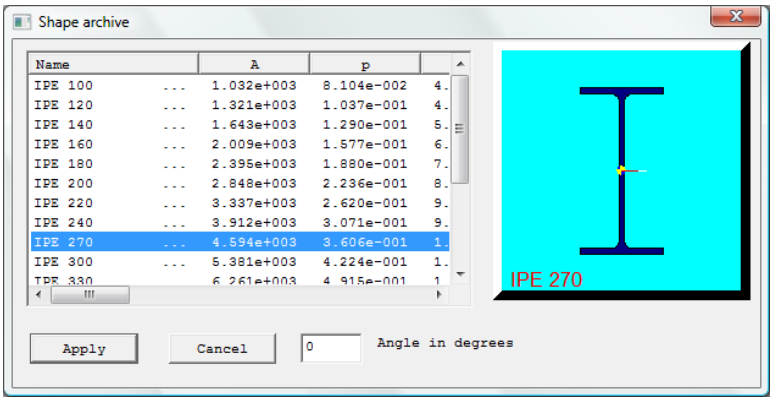
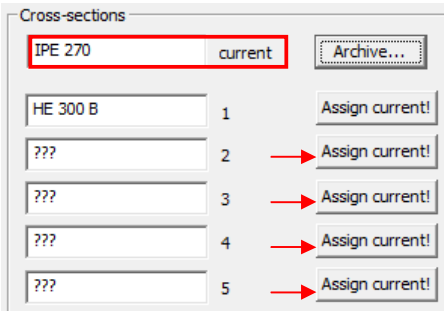
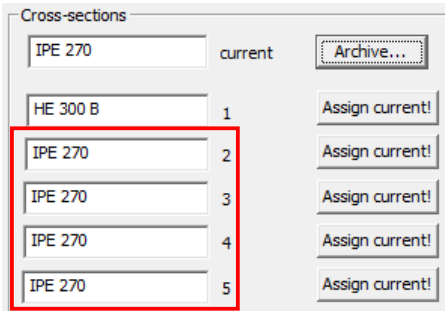
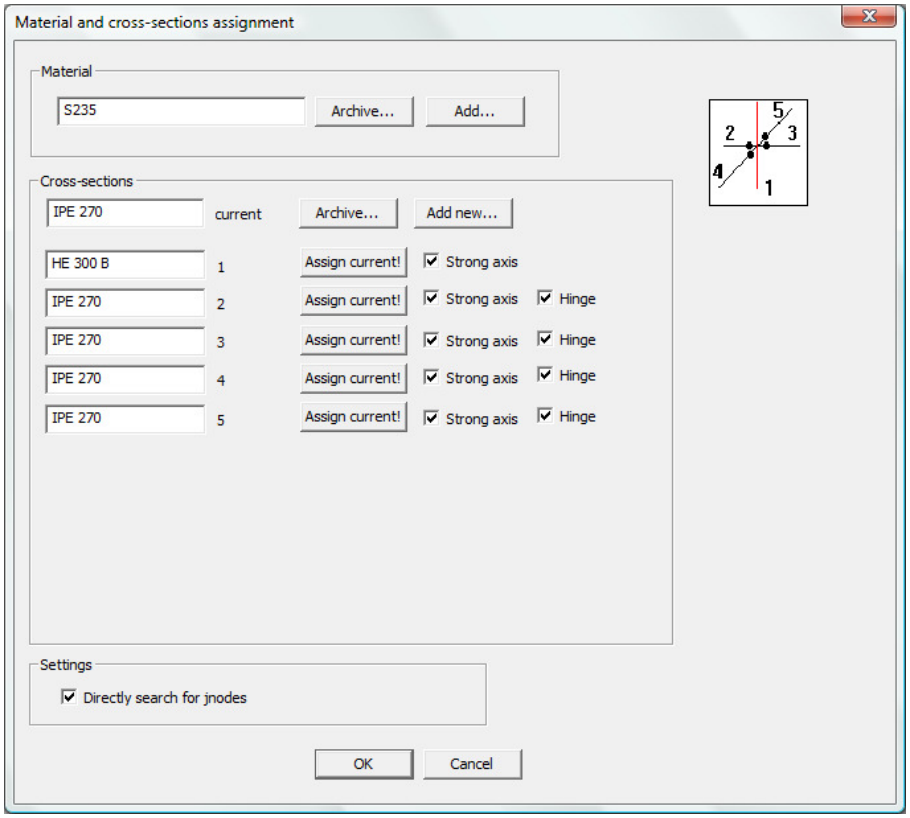


Now current shape is IPE270. Click “Assingn current!” buttons to assign it to members 2, 3, 4, 5.







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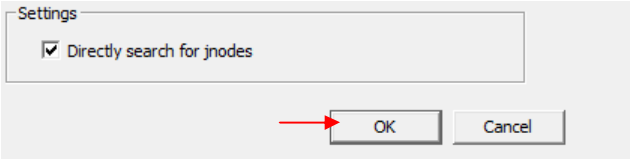
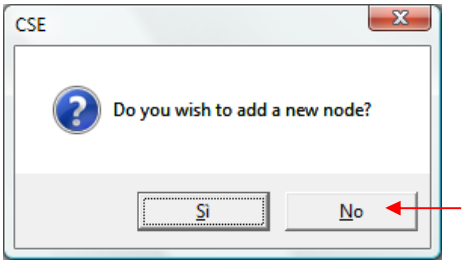
Tick the “Hinge” buttons of members from 2 to 5 in order to define hinged connections. The node has been defined, with its geometry, material, cross-sections and kind of connections.

Leave the option “Directly search for jnodes” ticked and click OK to get the 3D real node (renode).

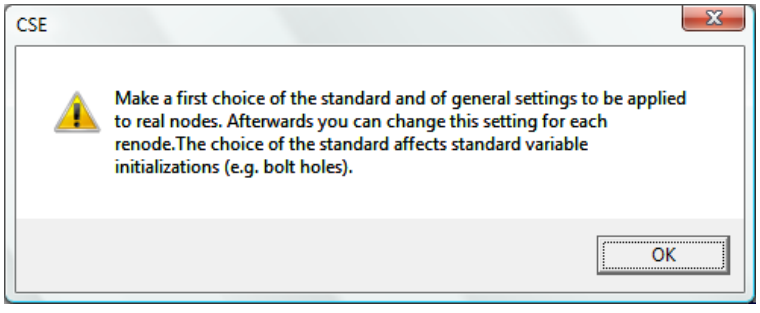


With this option on, members and jnodes are automatically searched. See tutorial 1 to know how to do this operations step by step.

“Do you wish to add a new node?” Click No.



Now CSE asks a pre-setting for the checks.



Checks setting dialog box is shown. Settings may be modified later, so we can skip this step and press OK without changes.

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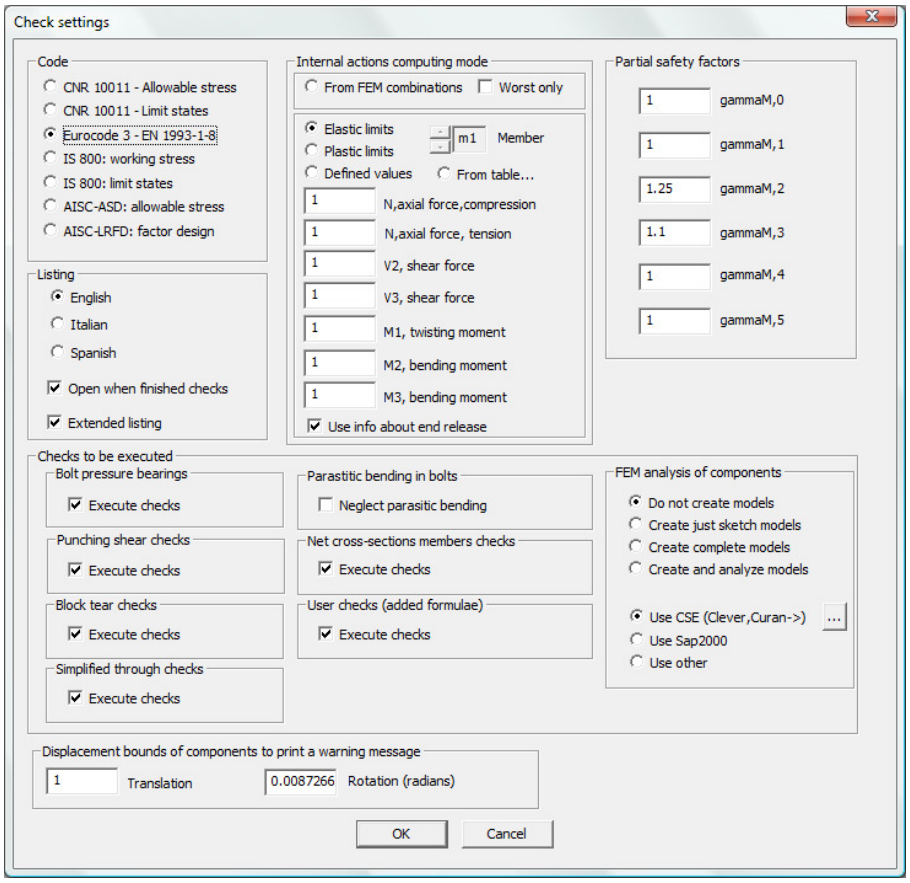
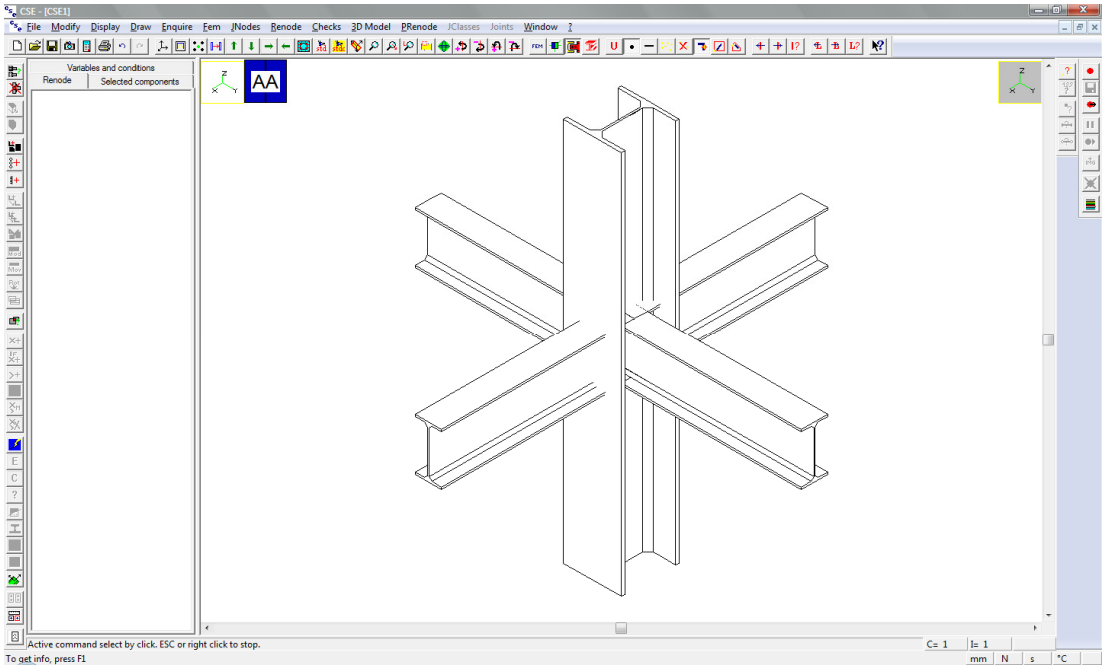


Finally, we get the renode, with members overlapping and not connected.

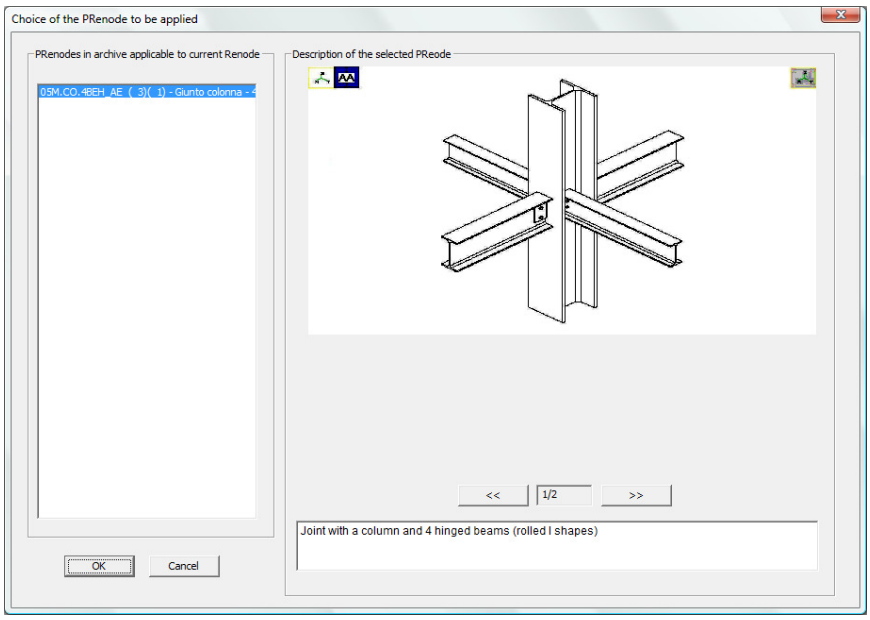


2.2 APPLYING A PARAMETRIC RENODE

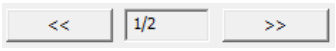
We have an empty renode. If there are similar prenodes in the archive, we can apply them to our renode. Use the command

Renode – Assign Prenode

In the archive there is one parametric renode similar to current renode, so in the next dialog box it is shown.

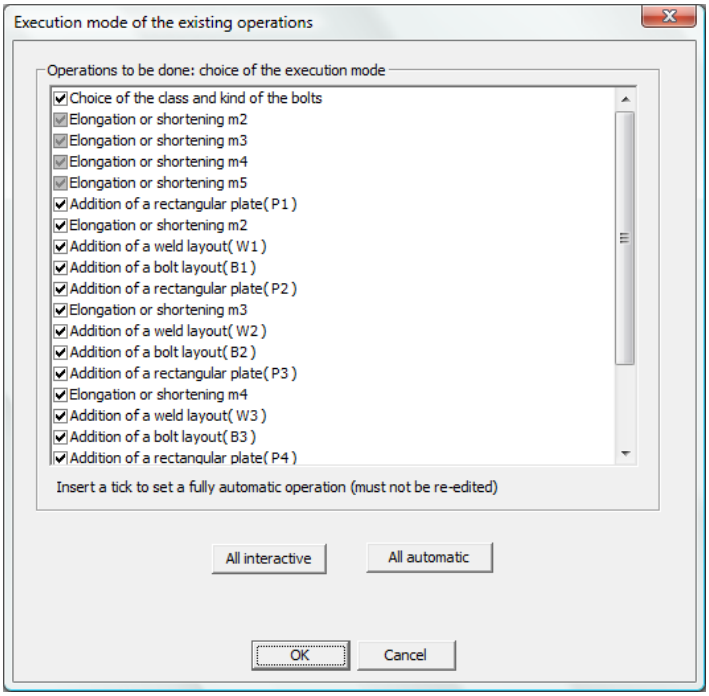


Use the arrows to see all the available pictures of the prenode highlighted in blue (the only one in this case).

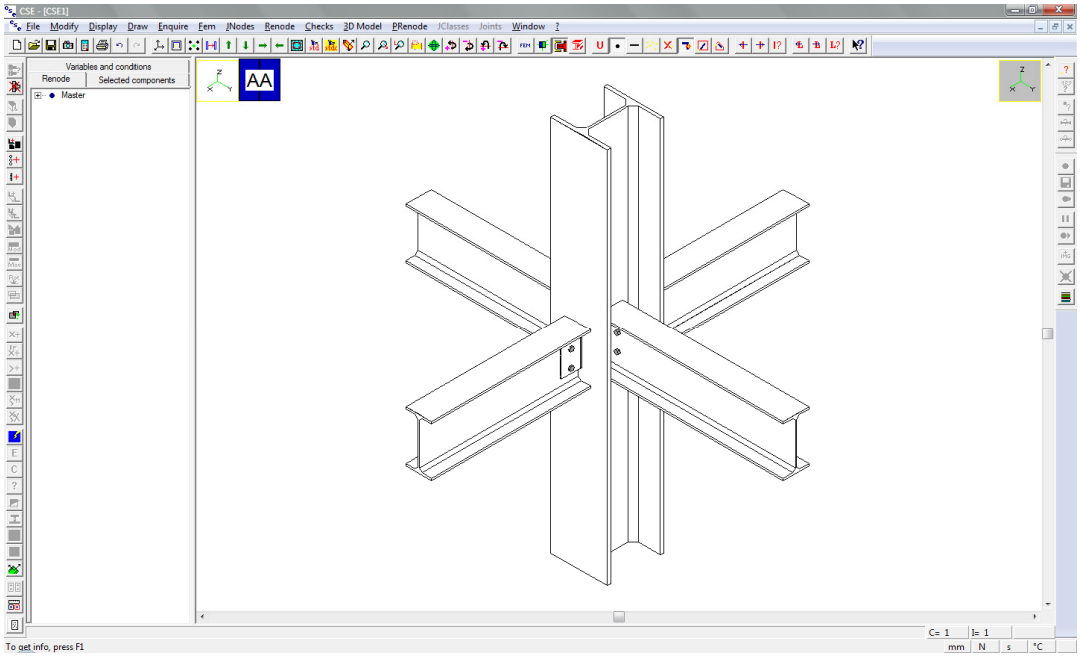


Press OK to apply this prenode.

In the following dialog box, all the operations for renode construction (depending on the current prenode) are listed. They are all ticked, it means that they will be automatically applied exactly as they are saved in the prenode, without any change of parameters and data.



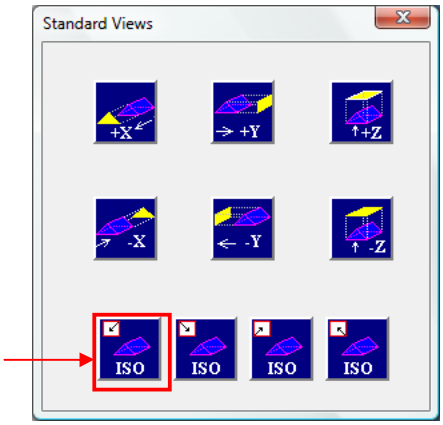
Press OK and the renode will be automatically constructed following chosen prenode.



Use **Modify – Select –None** to unselect all components.

Use the **Draw – Rotate**… commands to see the node from other points of view.

Use **Draw – Standard view** and restore original view.

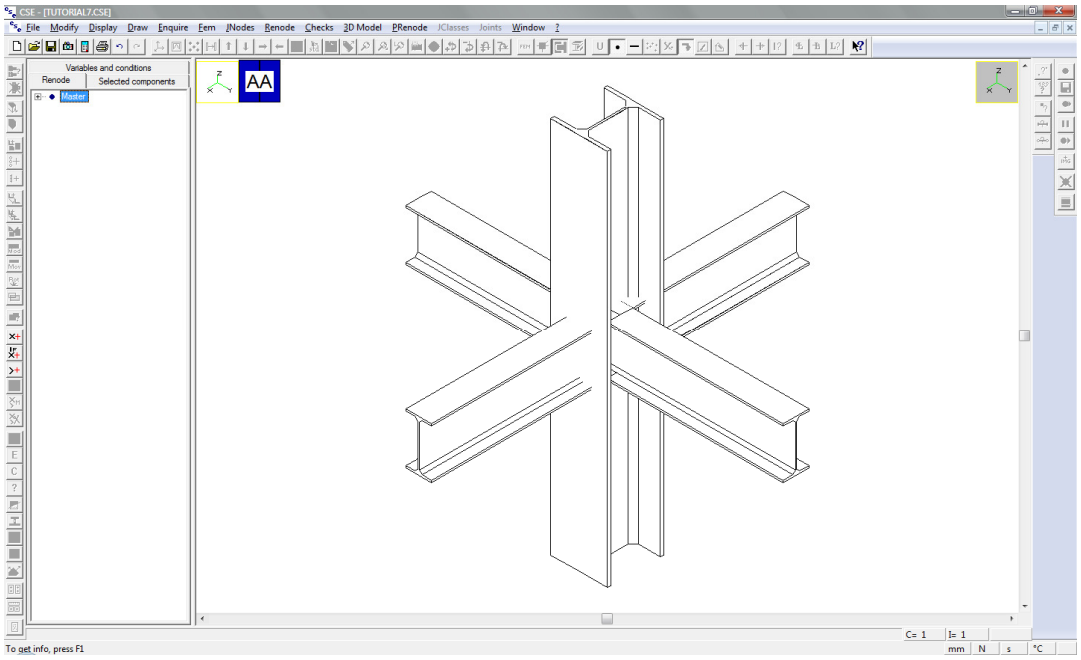


2.3 MODIFY PRENODE PARAMETERS DURING THE APPLICATION

Use the command

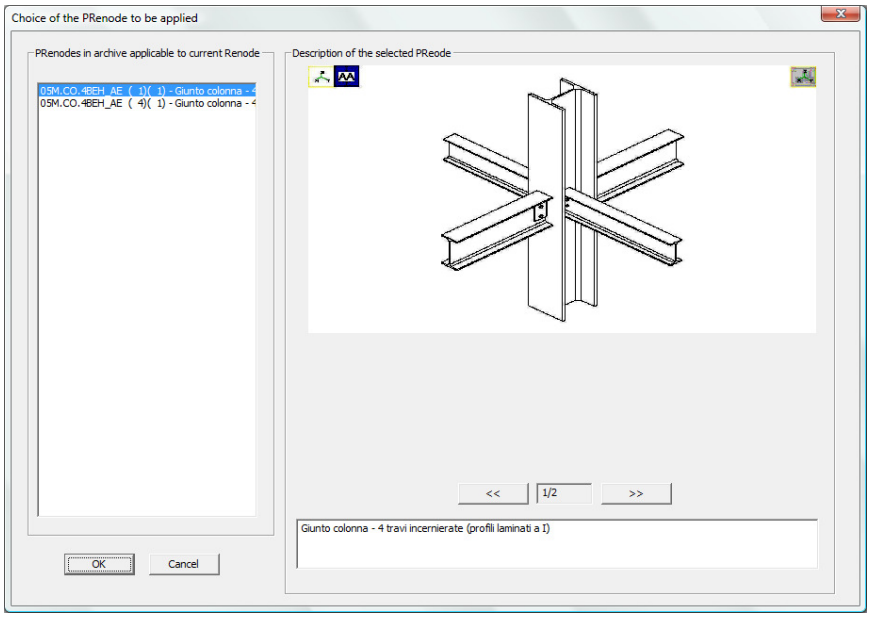
Renode - Reset renode content!

to clear the renode and make it “empty” again.

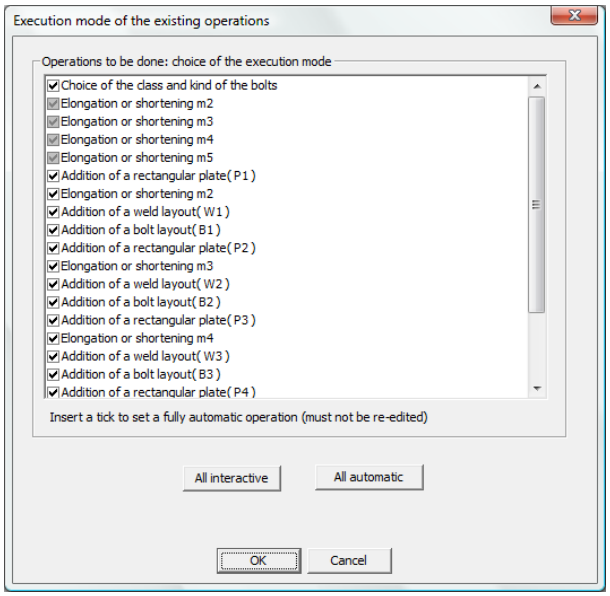


As previously done, use the command

Renode – Assign Prenode

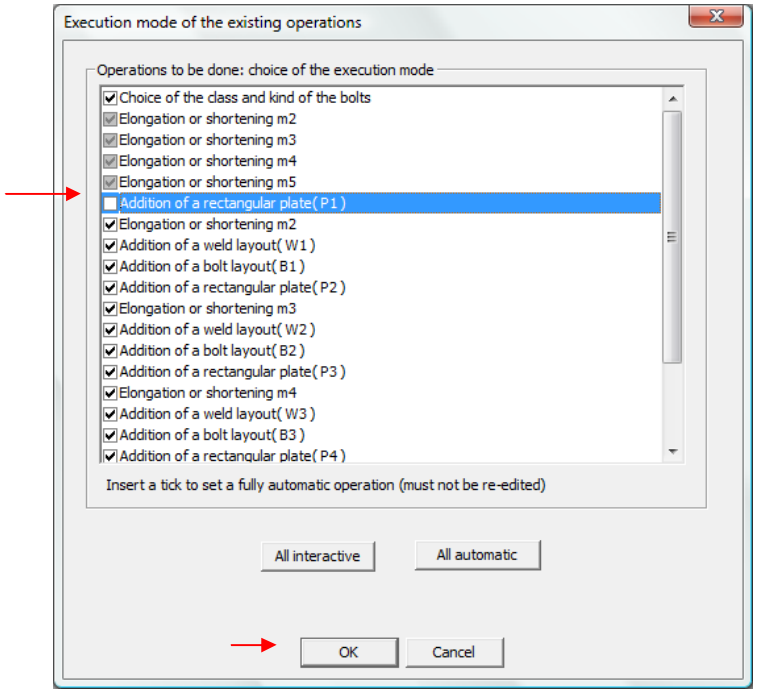


N.B. now there are two possible applications of the same prenode: they have the same name, but one ends with (1)(1) and the other one with (4)(1). This happens because during the first application of the prenode slave members were renumbered to fit the order saved in the prenode. Now, with the new renumbering, there are to possible applications of the same prenode. Click OK to apply the first one.



The first time we have clicked OK in this dialog box, leaving all the operations of the list ticked. So all these operations were done automatically with the parameters saved in the prenode.

If you want to change the parameters of an operation, just remove its tick. For example, we want to change the parameters of P1 plate: remove its tick a press OK.

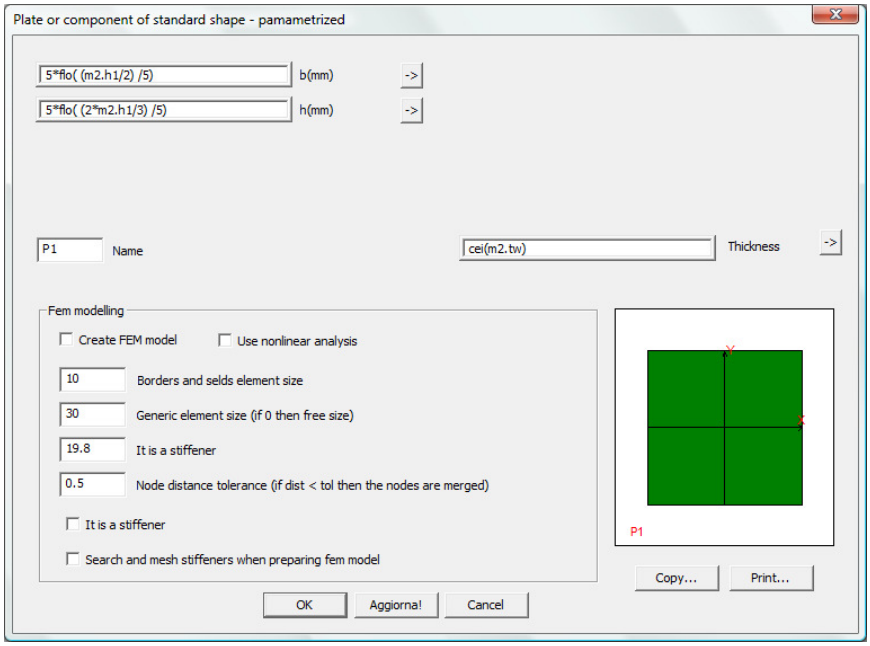


N.B. now we are just changing a single component, but more operations can be changed (with the exception of grayed ones). Button “All interactive” removes all the ticks (where it is possible); button “All automatic” restores all the ticks.

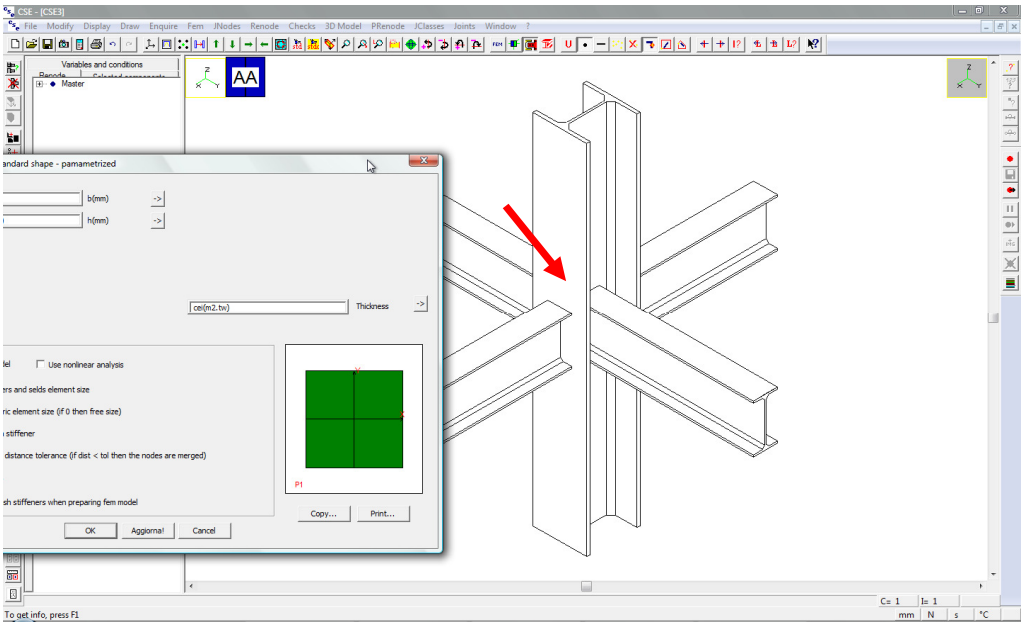
When we press OK, the construction of the renode following the prenode starts.

The first time we used the command there were no operations without tick, so the construction was completely automatic and without interruptions.

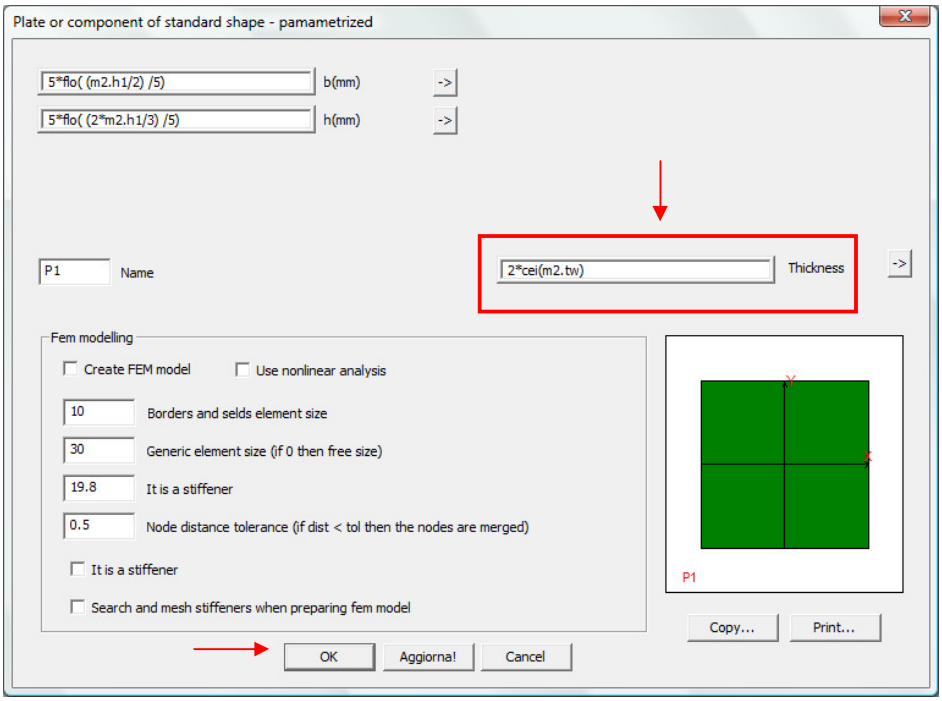
Now, since there is an operation without tick, the construction will stop at the definition of P1 plate parameters, showing the associated dialog box.



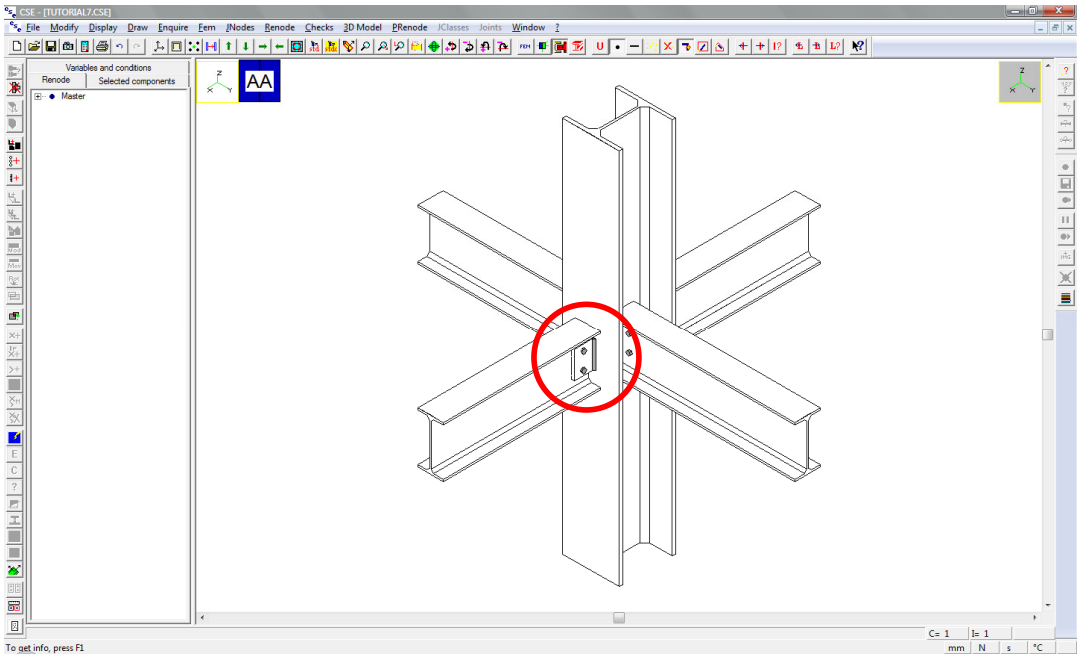
N.B. if you move the dialog box away from the node, you can see that some operations have been already done (slave members trimming to avoid overlapping).



In the dialog box for P1 plate definition, modify for example the thickness of the plate. In order to clearly understand what happens, define a thickness that is the double of previous one: current thickness is *cei(m2.tw)*, it means equal to the tickness of member 2 web rounded up to the nearest integer. Type " *2** " in order to get *2*cei(m2.tw)*, twice the original plate tickness, then press OK.



Renode construction is automatically completed. Now P1 is thicker and other components are coherent with this modification (for example, weld layout connecting P1 to the master).



In this example we just modified the thickness of a plate, but also other components and operations can be changed. For example:

- bolt layouts (diameter, disposition, just shear/anchor/bearing surface options, etc.);
- weld layouts (disposition, thickness, penetration/fillet welds);
- plates, angles and other components sizes and parameters for automatic FEM models;
- work processes (for example bevels and cuts sizes);
- additional variables and conditions;
- check settings;
- etc.

Components can be modified also with standard renode commands after prenode automatic application, but it is often faster and easier to change desired parameters during a re-application of the prenode.

With the FULL version of CSE it is possible to add new components, work processes, etc. after a prenode application, as during the manual construction of a renode in the standard way.

2.4 DIFFERENCES USING THE LIGHT VERSION

To get the empty renode, use the command

Nodes – Typical nodes

Dialog boxes for the choice of the structure and for the definition of material, shapes and kind of connections are the same of the FULL version. Once you have the empty renode, use the command

Nodes – Assign PRenode

With the LIGHT version it is not possible to add new components or new work processes. These operations can be done with the FULL version only.

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