**TRUSS – 2D and 3D v1.04**

*Name of program:* ***ThreeDTruss***

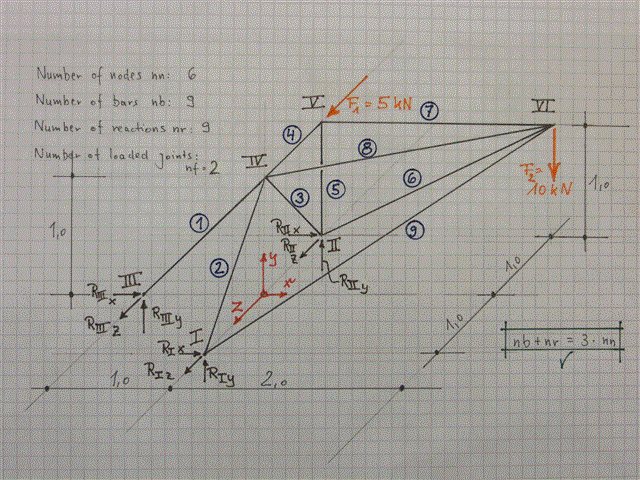
The program calculates the longitudinal bar forces in a 2-dimensional or 3-dimensional truss. The input consists of four parts: ***1.)*** input of node coordinates, ***2.)*** input of bars and their definition by start node n**i** and end node n**j**, ***3.)*** definition of supported nodes and **4.)** joints loaded by forces **Fx,Fy,Fz**. Then the program builds up the matrix[(*nb*+*nr*),(*nb*+*nr*+*1*)] of the equations of equilibrium for ***nb*** bars and ***nr*** support reactions of the entire system and solves it by means of the RREF-command. The orientation of the coordinates for a two-dimensional problem is a *x–y* – system y

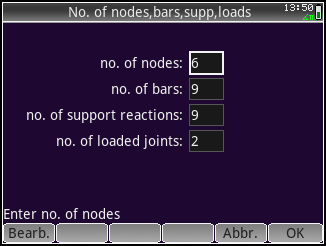
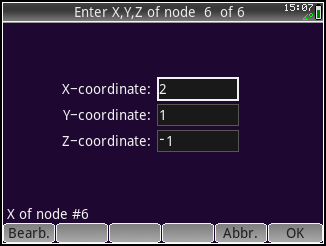
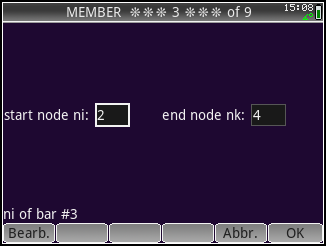
x

or a system *x – y – z* orientated according to the right-hand rule as shown in *fig*. *1* of the 3-D-example ( thumb points to ***x***, forefinger: ***y***, middle-finger: ***z*** ).

The execution is demonstrated for the example depicted in *fig. 1* defined by **6** nodes, **9** bars, **9** support reactions and **2** loaded nodes. The input of data of a 2-D-system applies in the same way except that the inputs bearing index …z are omitted.

Load *ThreeDTruss* to the Prime, then start it from the toolbox and select 1 ***ThreeDTruss***. The sub-program 2 ***newload*** provides the resumption of a recently computed system and will be discussed later. On the next prompt select 2 ***3-D***. The screen now asks for the input of number of nodes ***nn*** , number of bars ***nb***, number of support reactions ***nr***, and number of loaded joints ***nf***, where a joint may have up to three loads *(fig. 2 and 6*).

* fig. 1)*

*fig. 2.) fig. 3) fig.4)*

The criterion for a 3-D-system statically determinate is met: ***nr*** + ***nb*** = 3\****nn*** 9+9 = 3\*6. Now enter for each node its coordinates ***x, y, z*** referred to the chosen coordinate system as listed in *Table 1* and demonstrated for node 6 in *fig. 3*), cf. head-line of the screen. Part ***2.)*** of the input routine is the entry of start node n**i** and end note n**j** for all members (displayed on the top), (*table 2* and *fig. 4*). The next entry defines the nodes bearing a fixed support, indicated by a ***1*** for the corresponding coordinate (*table 3* and *fig. 5*). You may also input ***-1***, the result for this support will then be displayed with changed sign. At last the input of the joints bearing loads ***Fx,Fy,Fz*** occurs (*table 4* and *fig. 6*).

*Node x y z member n****i*** *n****j*** *fixed node x y z*

1 0 0 1 1 3 4 1 1 1 1

2 0 0 -1 2 1 4 2 1 1 1

3 -1 0 0 3 2 4 3 1 1 1

4 0 1 0 4 4 5 ***Table 3***: fixed joints

5 0 1 -1 5 2 5

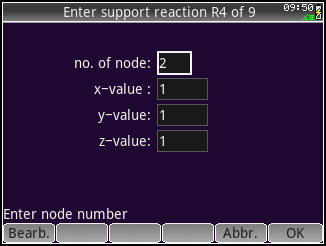
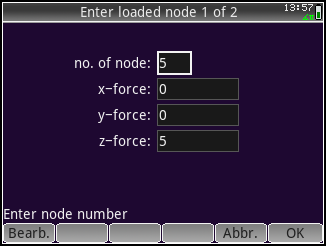
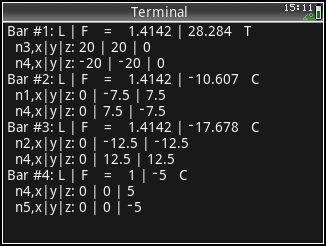
6 2 1 -1 6 2 6 *loaded joints Fx Fy Fz*

7 5 6 5 0 0 5

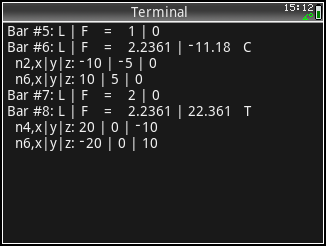
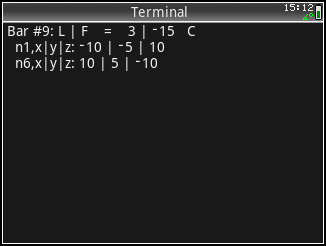
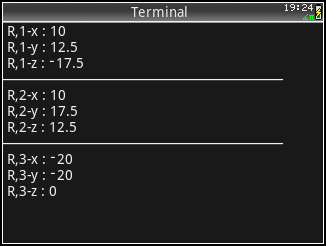
***Table 1***: node coordinates 8 4 6 6 0 -10 0

9 1 6 ***Table 4***: loaded joints

***Table 2***: member - end nodes

*fig. 5.) fig. 6) fig.7)*

*fig. 8.) fig. 9) fig. 10)*

Output are the bar ***L***engths and -***F***orces (*fig.7-9*), the last of which are | + | , | - |

tension compression

positive and marked by **T** acting away from nodes, negative and marked by **C** towards nodes. Line 2 and 3 of each bar display the force components ***Fx,Fy,Fz*** for both nodes. E.g. the Fx- and Fy-vectors of member 1, node 4 both have the value -20, as acting away from that node towards negative x- and y-coordinate. For more than four members press the Enter-key to continue the output for the following bars.

The last screen (*fig. 10*) depicts the reaction forces *R,n-i* ,where *n* indicates the node and *i* stands for the appropriate coordinate. Pressing Enter prompts either for 1 **New loadcase** or 2 **QUIT** leaving the program and return to the home screen displaying **two** lists. These include the bar lengths as well as member- and reaction forces in EXACT-mode. To handle the recent system with other loads start ***ThreeDTruss*** by the toolbox-key and select 2 ***newload*** to start part ***4.)*** of the input routine. In this case be sure to have not affected the EXPORT-variables ***ll***, ***nn, nb, nr, nf, dd, idx*** meanwhile!

**HINTS and WARNING**

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