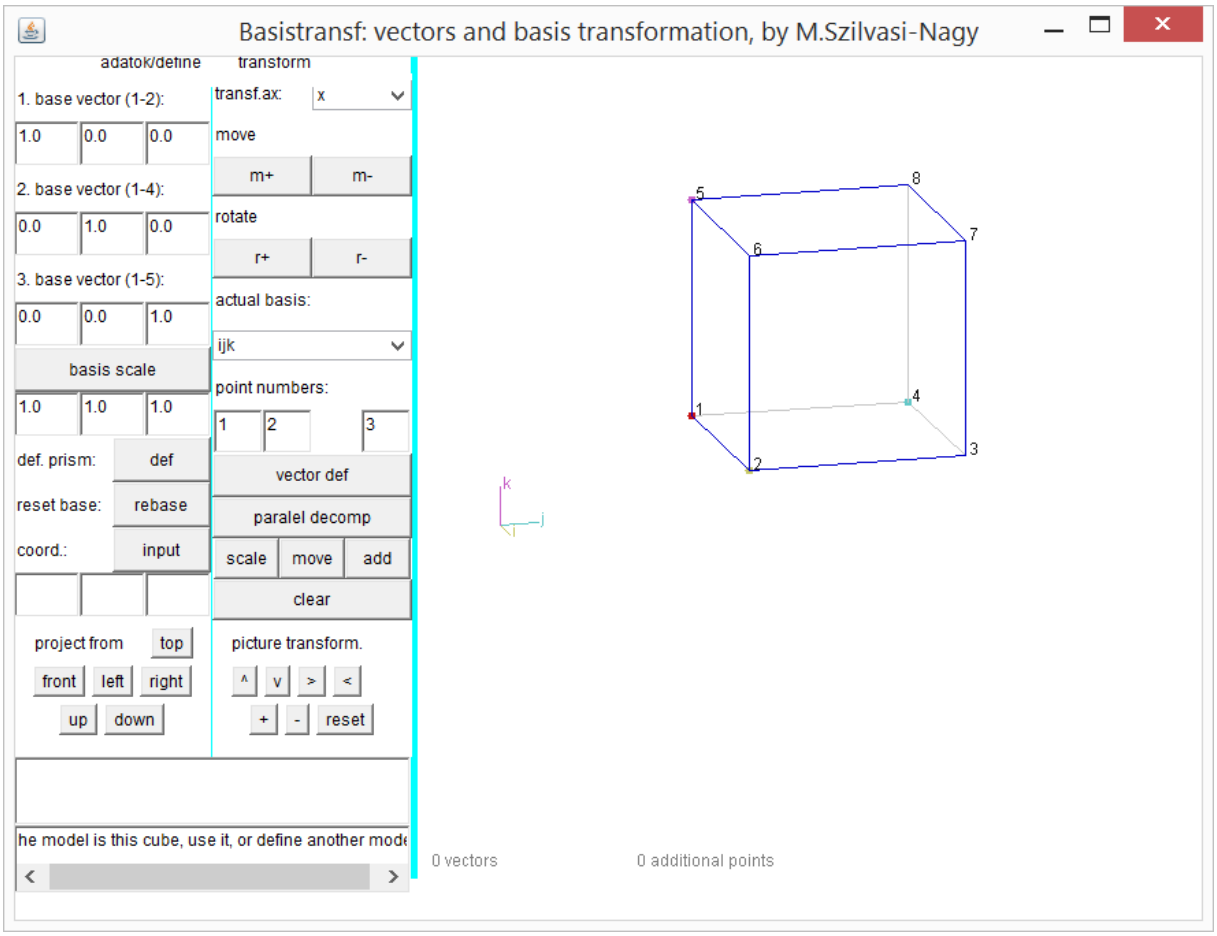
Basistransf: a program for visualizing vectors, scaling, moving, addition of vectors and basis transformations.

The window of the program may appear in icon-size. In this case enlarge the window!

Use the menu system! The mouse is not active in the drawing field!



Two bases of the three dimensional vector space are defined in the program:

The natural basis *i,j,k* (default) are the three edge vectors *1-2, 1-4, 1-5* of the four sided prism (it is the unit cube at the beginning, the origin is in the corner point number 1). The coordinates of the edge vectors in the basis *i,j,k* are shown on the upper left side of the menu.

You can change the coordinates of the edge vectors, and define a new prism by the button *def*, or scale them by entering three scaling factors (instead of 1, 1, 1) and clicking to the button *basis scale*.

The edge vectors can be changed also by transforming the prism by rotation (*rotate*) around a given axis (*transf ax*:). The command *move* moves the prism along the given axis, but this does not change the basis. You switch between the bases *i,j,k* and the edges *1-2, 1-4, 1-5* by the help of the choice button *actual basis* (the default basis is *i,j,k*).

A vector is defined:

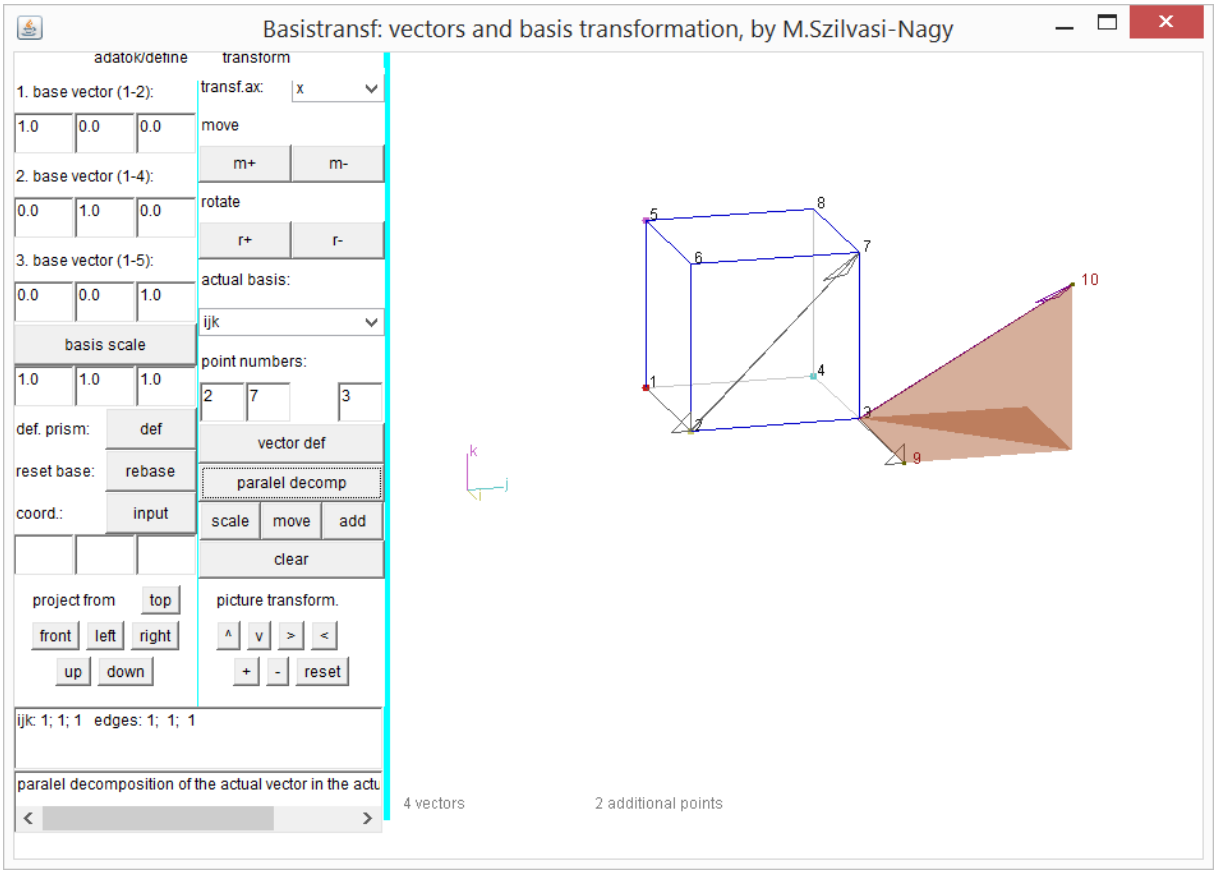
by specifying its numerated starting and end points in the text fields of *point numbers* (1, 2 in the starting menu) then clicking to the button *vector def*. The third number is also a point number (it

specifies the new starting point in the command *move* a vector) or a factor of *scaling* the actual vector.

The other definition method is entering the three coordinates in the actual basis in the 3 text fields below coord: on the left side in the menu, then by clicking to the button *input*.

Examples

1. Vector definition, moving, addition of vectors, paralel decomposition



Give the following commands:

vector def creats the vector 1-2, *move* moves it into the vertex nuber 3, write the point numbers 2 and 7 into the first two places of point numbers, and *add* this vector to the actual (last) vector. The new actual vector is 3-10, *paralel decomp* shows its paralel decomposition in the actual basis. On the lower left side of the menu the vector coordinates appear. The two bases are the same now.

Shrink the picture, if it is larger than the window by the „–” button of *picture transform*.

clear deletes the vectors.

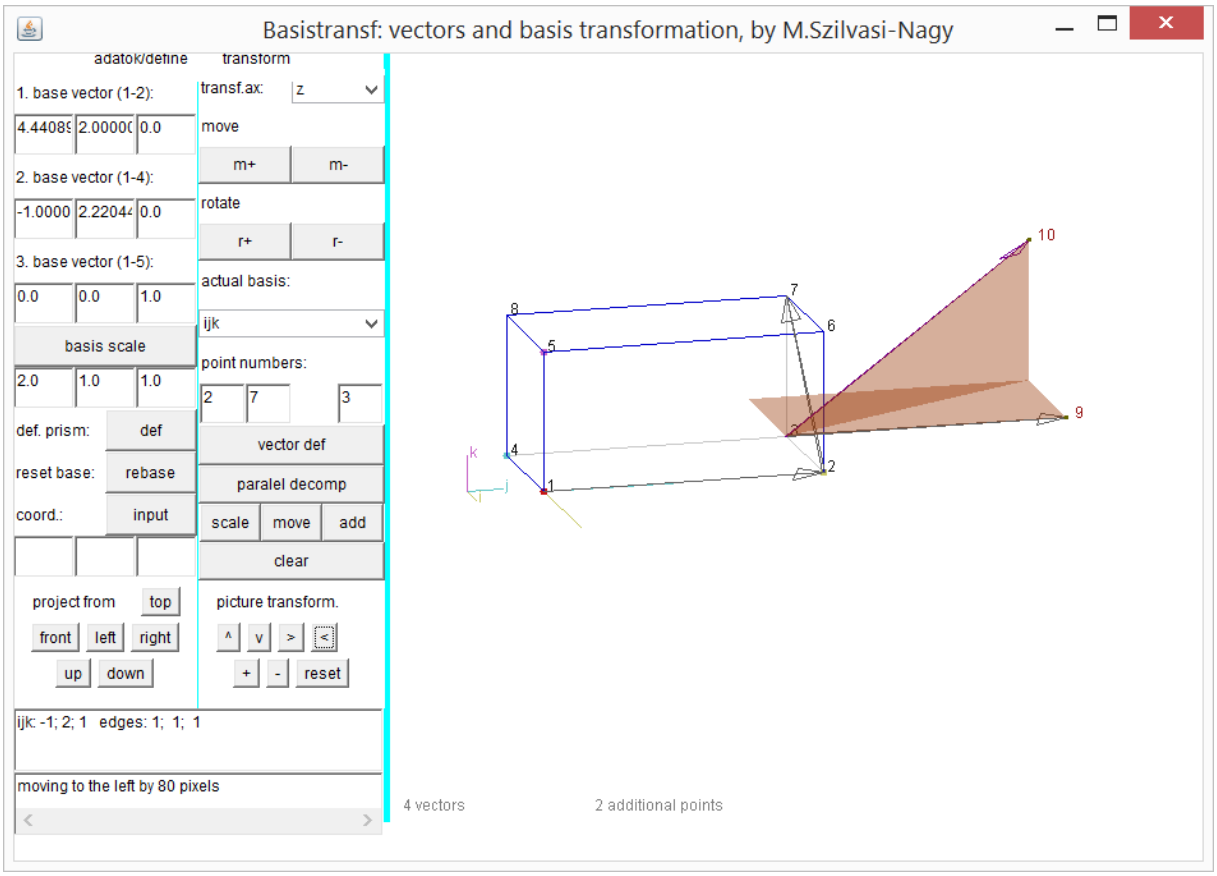
2. Coordinate transformation by scaling and rotating the basis vectors, changing the projection's direction

Give the following commands:

Enter 2 into the first text field of *basis scale,* press this button, chose z for transformation axis, rotate the prism around it by 90 grad by pushing *r+* 6-times, then carry out the same vector definitions as in example 1 (*vector def* 1-2, *move* into 3, *add* 2-7).

Picture transformation is necessary, because the resulting vector 3-10 is not in the window. Click on the buttons „<” twice and „v” one times. *paralel descomp*osition shows the coordinates.

You may watch the prism and the vectors in other projectios by choosing *top* or *front* and changing the direction of projection by the commands *left*, *right*, *up* and *down*.



You may reset the original *i,j,k* base by the command *rebase* and define the prism by *def* with these edges. The vectors will be deleted.

3. Vector coordinates in a new basis, numerical definition of vectors, position vectors, point coordinates

Give the following commands:

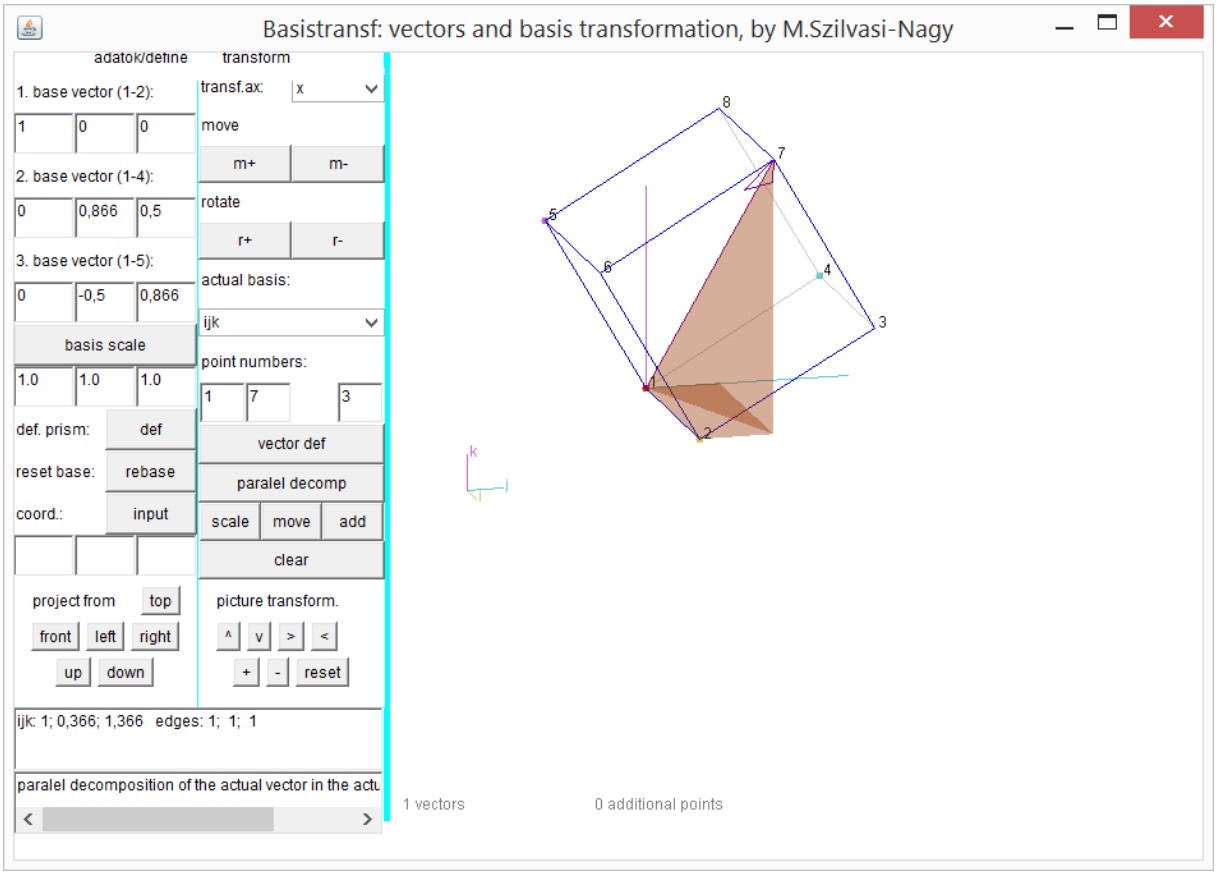
clear the vectors, reset the picture, reset the base, define the prism again,

rotate the prism around the transformation axis x by clicking r+ twice,

set the actual basis instead if *i,j,k* onto *edges,*

set the point numbers to 1 and 7, then define the vector, which is the diagonal vector in this prism,

switch the actual basis back to *i,j,k,* then the *paralel decomposition* shows the components in this original basis.



More examples

The actual basis should be the natural basis *i,j,k*. Rotate it around the x axis as in Example 3.

Define a vector numerically by entering the coordinates in the textfields coord: 0,0,1 and the command *input* creates the vector 1-9 showing into the z axis. Change the actual basis into *edges,* then push the button *input* again, the new vector 1-10 is identical with the edge vector 1-5.

The coordinates of a vector do not change by moving it into an other point! These are free vectors!

The coordinates of a point are defined by the coordinates of its position vector. The starting point of the position vectors is the origin, defined by the point number 0. It is the vertex number 1 in the starting position.

Move the prism by clicking to the button m+ (7-times). Find the coordinates of the vertex number 1. Its position vector is the vector 0-1. Enter the numbers 0 and 1 into the text fields *point numbers*, then push the button *vector def.* The command *paralel decomp* computes the coordinates. You may find out the coordinates of an arbitrary point similarly: first generate its position vector starting from the origin of number 0, then click to the command *paralel decomp.* Compute the coordinates of a vector between two points as the difference of the two position vectors! Then check the result by defining this difference vector by its endpoints!

Create new examples and have a lot of fun!

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