

START OF THE PROGRAMS OF THE REALIZATION OF THE GRAPHIC
MEANS INTO THE LIBRARIES OF THE COMPLEX

5.1. Functions of the programs of the realization of the graphic means
and the structure of operator SUBROUTINE.

After the completion of the sequential step of integration, in the case, if in the text of program in the language PRADIS it was present the description of the image of object, occurs turning to the programs the realization of graphic means for the reconstruction of image the current state of object on the screen.

In the complex PRADIS with the description of the image of the object there are several rules of the construction of the images, which they predetermine existence of several varieties of the programs the realization of graphic means. FIRST METHOD of the description the image of object - this is the use of graphic means, the connected with the models elements "on silence". Some of the model of the mechanical elements, which accomplish flat and spatial motion) they are connected with its means "on to silence ". In this case with the description of the image of the object it is possible not to indicate, what graphic means corresponds to that or to another element. SECOND METHOD of describing the image of the object - this explicit indication, what graphic means (it is possible, nonstandard) corresponds to one or another element.

Examples of the corresponding descriptions of the images of the object:

I SHOW:

```
{
  the image of all elements of object, which have
  graphic means "on silence"
}
Entire image 'LAYER (;Parameters of layer 1)
{
  the image of elements with the identifiers "connecting rod" and
  "Crank" with the use of graphic means on
  to silence
}
Image of [mekhanizma]' LAYER (connecting rod, crank;
                               Parameters of layer 2)
{the image of elements with the identifiers "connecting rod" and
  "Crank" with the use of the nonstandard
  graphic means}
The different version of [izobrazhenija]'LAYER (
  Connecting rod (SHTN;Parameters of the image of connecting rod),
  Crank (KRVSH; Parameters of the image of crank);
  Parameters of layer e
)
```

One additional possibility of constructing the image, this the image of the graphic means, not connected with the elements the image of object, and connected with the fixed coordinate system (this the graphic means of the image of the environment of object). Method the start of such programs in the image of the object

it is similar to the second method of the image of the elements of object, only in this case is not indicated the identifier of the element, to which this graphic means corresponds:

```
Image of the environment of mechanism 'LAYER (  
    (ROOM;Parameters of image);  
    Parameters of layer 2)
```

The following varieties are distinguished in accordance with this the programs of the realization of the graphic means:

- 1) the graphic means, connected with the model of element "on to silence ";
- 2) nonstandard graphic means;
- e) the graphic means, connected with the fixed system coordinates (fixed graphic means).

Operator OF SUBROUTINE for the graphic means of the first and the second type it appears as follows:

```
SUBROUTINE IMAGE (THE I,  
  , X1,...      X3,  
  , PAR, NEW, OLD, WRK,  
  , PARIMD, WRKIMD,  
  , PARLR2)  
  REAL * of 8 I (1), X1 (1),... X3 (1)  
  REAL * OF 8 PAR (1), OF NEW (1), OF OLD (1), OF WRK (1)  
  REAL * OF 8 PARIMD (1), OF WRKIMD (1), OF PARLR2 (1)
```

In this call:

The I - vector of the forces of the model of element, with which the program of the realization of the graphic is connected means. Graphic means must to change the elements of this vector;

X1... XN - massifs of potential variables for the units of the model of element, with which it is connected graphic means. It is necessary to note, that the sequence of these variables it corresponds to the order of the enumeration of the units with the description of the topology of element. In difference from the model of element is independent from the parameter ADR, into the graphic means it is always transferred all three potential the variables, which correspond to this unit (X1 (1) - displacement, X1 (2) - speed, X1 (e) - acceleration). Program of the realization it must not change graphic means the elements of the vector of the potential variables;

PAR, the vector of the parameters, state and the worker
NEW, OLD, the vector of the model of element, with which it is connected
WRK graphic means.

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ATTENTION! 1) graphic means must to change the elements of these massifs. 2) these massifs be present in the call of the program the realization of graphic means, even if in the operator SUBROUTINE of the model of the element equivalent components be absent. This is done for that, in order to some graphic means could be they are used for the image of different the elements, similar actually, but characterizing by operator SUBROUTINE.

PARIMD - vector of the parameters of graphic means.
Quantity of elements in the vector the parameters of graphic means it is assigned by the passport of graphic means. If is assigned PAR=0, BY PARIMD nevertheless it is present in the operator SUBROUTINE the program of the realization of graphic means.

WRKIMD - working vector of graphic means.
It is analogous to the appropriate massif [PRVP]. The length of working vector is determined by the passport of graphic means. If is assigned WRK=0, this massif nevertheless it is present in the operator SUBROUTINE the program of the realization of graphic means.

PARLR is 2nd the parameters of the current layer of image.

In the massif PARLR2 are contained 11 elements:

- 1- 3- of the coordinate of center of the screen for the current layer image;
- 4- ' the direction cosines of the axis OX of the coordinate system the current layer in the conglobulation of coordinates;
- " 9 direction cosines of the axis OY of the coordinate system the current layer in the conglobulation of coordinates;
- 10 [pikselnyj] scale of image;
- 11- current color of image.

NOTE. Majorities of the elements of massif PARLR2 not are necessary to user for the direct use (they they adapt in the program of obtaining the [pikselnykh] coordinates image GLASS).

The element can prove to be important for the user
PARLR2 (10) - the [pikselnyj] scale of image. [Pikselnaja] length the image of any element of length of L on the screen it is calculated as the work $L * OF \text{ PARLR2 } (10)$ (on the y axis), $L * OF \text{ PARLR2 } (10) *$

RELYX (along the x axis; apropos variable RELYX see the contents COMMON of block GRCONF in appendix 1). It is if necessary to calculate the [pikselnuju] length of any image by hand, it is necessary to bear in mind, that it depends on the current parameters of layer and in the course of computation it can change (if it adapts BY REPLACE for the parameters of the program of the realization of layer and RESTORE - restoration calculation from the last place of retention). Therefore this value it must be calculated with each entrance into the program of the realization graphic means.

Some more important element - PARLR2 (11). If by user it was required for any reasons to use the color of image, different from the color of image for the data layer, then it is necessary for the recovery to the primary color of image to use PARLR2 (11):

```

.....
INTEGER * OF 4 NUMCOL
.....
C recovery to the image by the color of layer on silence
  NUMCOL = OF INT (PARLR2 (11) + 0.5)
  CALL COLOR (NUMCOL)
.....

```

Operator OF SUBROUTINE for the graphic means of the third type it is differed from this operator for the means of the first and the second of the types:

```
SUBROUTINE IMAGE (PARIMD, WRKIMD, PARLR2)
```

I.e., the formal parameters, which relate to the model element, in this operator they be absent. For PARIMD, WRKIMD and PARLR2 act the same rules, that for the graphic means the first and second types.

From that state aboved follows, for example, that graphic the means, intended for the image of the element, which has 4 degrees of freedom, cannot be used for the image element with another quantity of degrees of freedom or to be connected with the program of the image of layer. If this is not obvious, it is better to re-read the information e given above again.

5.2. Passport of the program of the realization of the graphic means and the rule of the formation of the names [PGO], connected by the models of elements on silence.

Passport [PGO] (program of the realization of graphic means) it begins with the keyword IMAGE. The name goes after this, the subprogram, which realizes [PGO] and, after symbol ":" - the names the key parameters of passport and their value - positive integers.

In the passport [PGO] of user, included in the composition the libraries of complex, can be assigned the following key the parameters:

EXT - quantity of degrees of freedom of the model of element, with which is connected graphic means. For [PGO] the third type are assigned TO EXT=0;

PAR - quantity of elements in the vector of the parameters graphic means (PARIMD). If it is assigned PAR=0, is considered that this graphic means it will be connected with the model of element. In this the case the name of the program of the realization of the graphic means it is assigned according to the rules, formulated in this subsection below;

WRK - quantity of elements in the working vector [PGO] (WRKIMD).

Rules for the names of the graphic means, connected by the models of elements on silence:

1) if the name of the model of element contains 4 or shch of symbols, the name of the program of the realization of graphic means for this element it is the reversed name of the model of element. For example:

Name of the model of element the name of graphic means on silence

PLSTU - UTSLP
STRGN - NGRTS
KNT0 - OTNK

2) if the name of the model of element contains ' of symbols, then last symbol is rejected before reversing of name. For example:

Name of the model of element the name of graphic means on silence

BALKA - AKLAB
BALKAD - AKLAB
BALKAN - AKLAB

e) if the name of the model of element contains e of symbol and it is less, then before the reversing it is supplemented with symbols "G" to ' of symbols. For example:

Name of the model of element the name of graphic means on silence

K - GGGGGK
MU - GGGGUM

5.3. Basic principles, placed as the basis
the development of the programs of the realization of the graphic
means.

1) the programs of the realization of graphic means as everything
the programs of complex PRADIS, must satisfy
to the basic principle OF MOBILITY. This means that [PGO] not
it must use in its work of operations or actions,
dependant on the type of the utilized COMPUTER or type of those utilized
outlying devices. ALL INSTRUCTIONS [PGO] must be written
on the standard of language FORTRAN. By only permitted
the explicit description of the types is deviation from the standard
the parameters (INTEGER * 4, REAL * 8, etc), and the use
text variable NAME in the unnamed general block.

It is assumed that on each computational installation,
where functions the graphic guarantee OF PRADIS, accessible
means realize the so-called "lower level
graphs PRADIS ", which can be directly used
by the programs of the realization of graphic means.

If [PGO] will disregard these
by recommendations, its use on computer technology
another type it can be to a considerable degree hindered.

The description of lower graphic level PRADIS is given
in the appendix of 1 present management.

2) as a rule, for obtaining the [pikselnykh] coordinates
image must be used "the program of projection"
GLASS. This program with all conversions considers the scale
image and all changes in the position of the point of view
observer, given by the means of the input language of complex.
For example:

```
REAL * OF 8 XC, YC
INTEGER * OF 4 PXA, PYA
REAL * OF 8 PARLR2 (1)
.....
C let us determine center of circle in the the global
C to the coordinate system:
XC = 25.6
YC = 35.7
C obtained the coordinates of center in the meters
C we will obtain the [pikselnye] coordinates of the center
C of the circle
CALL GLASS (XC, YC, Z,
, PXA, PYA,
, PARLR2)
C PXA, PYA - [pikselnye] coordinates of the center
C of circle.
```

e) user does not worry about the possibility of the output of the part
the image of object beyond the limits of screen (image is cut
by the means of complex PRADIS).

OBSERVATION. With a very great increase in the image it is possible to obtain program interruption on the tactlessness integral operation, to division into zero, etc, connected by the limitedness of the idea of integers in the base packet FORTRAN, selected for the realization of the lower level of the drawing PRADIS on IBM PC. In the case of the appearance of this error fulfillment of assignments for the calculation with the key parameter of the program integration MODE=0 it will lead to the disappearance as the images object on the screen of display, so error as such (into this the case PRADIS it is not turned to the programs of the realization of the graphic means).

It is necessary to remember also that the graphic representation object in the course of computation it is expensive operation. Calculation goes it is considerably more rapid in the regime of mapping graphs and it is still more rapid generally without the drawing (MODE=0).

5.4. Reference information on [PGO].

At present the content of reference information on [PGO] still did not keep balance.

It is recommended:

1) not to give reference information for [PGO], connected by the models of elements on silence;

2) reference information for another [PGO] as far as possible to coordinate with the reference information for [PGO], already included in complex.

5.5. Examples of the programs of the realization of graphic means.

In this subsection division as a example it is brought the program of the realization of nonstandard graphic means.

```
C IMAGE ARROW:EXT=3, PAR=4, WRK=0
C
C
C the date of creation 09/03/93 03:09 am
C the date of last correction 09/03/93 05:40 am
C
C HELP the graphic means of pointer.
C HELP THE NAME:   Graphic means of the pointer, which moves
C HELP in the plane.
C
C HELP OF DEGREE OF FREEDOM:
C HELP 1- is progressive in the direction of the axis OX of the base
C HELP of pointer;
C HELP is 2nd progressive in the direction of the axis OY of the base
C HELP of pointer;
C HELP 3- is rotatory (it does not influence image).
C
```

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```

C HELP THE PARAMETERS:
C HELP 1- initial abscissa of the base of pointer;
C HELP 2- the initial ordinate of the base of pointer;
C HELP 3- the length of pointer;
C HELP 4- angle between the direction of pointer and the axis OX
C HELP (- 0.25 PI < OF ALFA < of 1.75 PI, discretion 0.5 PI)
C
      SUBROUTINE ARROW (THE I,
        , X1, X2, X3,
        , PAR, NEW, OLD, WRK,
        , PARIMD, WRKIMD,
        , PARLR2)
C
C the formal parameters
      REAL * OF 8 I (1)
      REAL * 8 X1, X2, X3
      REAL * OF 8 PAR (1), OF NEW (1), OF OLD (1),
        , WRK (1),
        , PARIMD (1), WRKIMD (1),
        , PARLR2 (1)
C
C the parameters of means and the local variables:
      REAL * OF 8 X, Y,
        , L, ALFA
      REAL * OF 8 COSAL, SINAL
      REAL * OF 8 XA, YA, Z,
        , XB, YB
      REAL * OF 8 KONTR1 (4,1), OF KONTR2 (4,2)
      INTEGER * OF 4 PXA, PYA
      INTEGER * OF 4 PXB, PYB
      LOGICAL * OF 4 FLOOD
C
C COMMON- region NOTAT
      REAL * OF 8 RLMAX, RLMIN, INTMAX, MSHEPS,
        , PI, REZB, REZC, REZD
      COMMON/NOTAT/
        , RLMAX, RLMIN, INTMAX, MSHEPS,
        , PI, REZB, REZC, REZD
C
      DATA KONTR1/0.0 D0, 0.1 D0, 0.6 D0, 0.1 D0/,
        , KONTR2/0.6 D0, 0.2 D0, 1.0 D0, 0.0 D0,
        , 1.00 D0, 0.0 D0, 0.6 D0, 0.2 D0/
C
      DATA Z/0.D0/
      DATA FLOOD/OF.TRUE./
C
C the parameters of the means:
      X = PARIMD (1)
      Y = OF PARIMD (2)
      L = OF PARIMD (E)
      ALFA = OF PARIMD (4)
C
C the direction cosines
      IF (ALFA .GT. - 0.25 D0 * PI .AND.
        . ALFA .LT. 0.25D0 * PI)
        , THEN

```

```

        COSAL = L
        SINAL = 0
    ELSE
        IF (ALFA .GT. 0.25D0 * PI .AND.
        .      ALFA .LT. 0.75D0 * PI)
        , THEN
            COSAL = 0
            SINAL = L
        ELSE
            IF (ALFA .GT. 0.75D0 * PI .AND.
            .      ALFA .LT. 1.25D0 * PI)
            , THEN
                COSAL = - L
                SINAL = 0
            ELSE
                COSAL = 0
                SINAL = - L
            END IF
        END IF
    END IF
C
C we sketch the rectangle:
C
    XA = X1 + of X + KONTR1 (1,1) * OF COSAL -
- KONTR1 (2,1) * OF SINAL
    YA = X2 + Y + OF KONTR1 (1,1) * OF SINAL +
+ KONTR1 (2,1) * OF COSAL
    CALL GLASS (XA, YA, Z,
, PXA, PYA,
, PARLR2)
    XB = X1 + of X + KONTR1 (3,1) * OF COSAL -
- KONTR1 (4,1) * OF SINAL
    YB = X2 + Y + OF KONTR1 (3,1) * OF SINAL +
+ KONTR1 (4,1) * OF COSAL
    CALL GLASS (XB, YB, Z,
, PXB, PYB,
, PARLR2)
C
    CALL RECTAB (PXA, PYA, PXB, PYB, FLOOD)
C
C we sketch the triangles:
    XA = X1 + of X + KONTR2 (1,1) * OF COSAL -
- KONTR2 (2,1) * OF SINAL
    YA = X2 + Y + OF KONTR2 (1,1) * OF SINAL +
+ KONTR2 (2,1) * OF COSAL
    CALL GLASS (XA, YA, Z,
, PXA, PYA,
, PARLR2)
    XB = X1 + of X + KONTR2 (3,1) * OF COSAL -
- KONTR2 (4,1) * OF SINAL
    YB = X2 + Y + OF KONTR2 (3,1) * OF SINAL +
+ KONTR2 (4,1) * OF COSAL
    CALL GLASS (XB, YB, Z,
, PXB, PYB,
, PARLR2)
C

```

```

      CALL TRGLAB (PXA, PYA, PXB, PYB, FLOOD)
C
      XA = X1 + of X + KONTR2 (1,2) * OF COSAL -
- KONTR2 (2,2) * OF SINAL
      YA = X2 + Y + OF KONTR2 (1,2) * OF SINAL +
+ KONTR2 (2,2) * OF COSAL
      CALL GLASS (XA, YA, Z,
, PXA, PYA,
, PARLR2)
      XB = X1 + of X + KONTR2 (3,2) * OF COSAL -
- KONTR2 (4,2) * OF SINAL
      YB = X2 + Y + OF KONTR2 (3,2) * OF SINAL +
+ KONTR2 (4,2) * OF COSAL
      CALL GLASS (XB, YB, Z,
, PXB, PYB,
, PARLR2)
C
      CALL TRGLAB (PXA, PYA, PXB, PYB, FLOOD)
C
      RETURN
      END

```