PRADIS

REFERENCE BOOK ON THE MODELS
MODULE MECHANICS2

THE SOFTWARE FOR SIMULATION OF NON-STATIONARY PROCESSES IN MECHANICAL SYSTEMS AND SYSTEMS OF OTHER PHYSICAL NATURE

VERSION 4.3

Contents

1. The mechanical models

1.1. CG2PR - Cam drive 2d with the plate cam and the roller pusher

Cam drive 2d with the plate cam and the roller pusher

DEGREES OF FREEDOM:
1 displacement of the axis of hammer by means of the axis OX;
it is 2nd the displacement of the axis of hammer by means of the axis OY;
3- the angle of rotation of hammer around its own axis;
4 displacement of the axis of roller by means of the axis OX;
it is 5th the displacement of the axis of roller by means of the axis OY;
6 angle of rotation of roller around its own axis;
7 shearing strain on the contact

PARAMETERS:
1 the origin coordinate of the axis of hammer across the x axis
it is 2nd the origin coordinate of the axis of hammer across the y axis
3- the initial angle of rotation of hammer (before deg.)
4 thickness of the fist (> 0)
the modulus of elasticity of the material of the fist (> 0) is 5th
6 Poisson ratio of the material of the fist (> 0 I of <0.5)
7 the origin coordinate of the axis of roller across the x axis
it is eighth the origin coordinate of the axis of roller across the y axis
9 radius of the roller (> 0)
10 modulus of elasticity of the material of the roller (> 0)
11- Poisson ratio of the material of the roller (> 0 I of <0.5)
12- frictional drag coefficient (>= 0 I of <1)

Coordinates the radius-the vector of the profile of hammer (j=1, N):
2*j+11- angular coordinate j-the point of the profile of hammer (before deg.)
2*j+12- radius-vector j-the point of the profile of the hammer
---
Notes:
1) it will assume. the reference direction of the angles - counterclockwise;
2) the angle of rotation of fist is equal down the angle of deflection of the zero line (reference line of cam profile) from the axis OX;
3) a minimum quantity of points of cam profile - four;
4) the radius part of the profile must be assigned by two extreme by the points - A QUANTITY OF RADIUS SECTIONS IS NOT MORE THAN 5!!!
5) the angle between the adjacent sections of cam profile - not less than 120 and not more than 180 deg (with exception of radius sections);
6) with the task of the points of cam profile angular coordinate always it is non-negative and increases from the point to the point, the value the radius-vector it is always non-negative;
7) cam profile is considered closed - the last given point profile automatically it is connected with the first.
8) the profile of hammer must have at least one radius section, in this case the initial point of profile must correspond to the beginning what-or radius section, and the latter - to the end of the same

radius section.
9) the model of element limits the step of integration by value,
allowing the turning of fist against the step not more than on 90 deg.

ELEMENTS OF THE WORKING VECTOR:
(Signs of forces and speeds are given before the projections beyond such local the system of coordinates OX'Y' of hammer, before which axis OY' it is directed across the external normal to the hammer, and axis OX' is directed along the tangent to the hammer it defends from the axis OY' at angle of 90 deg., calculated between the axis OY' against the hour of pointer)

1 normal force down the hammer against the contact point;
it is 2nd frictional force down the hammer;
3- the moment of frictional forces down the hammer
4 half-width of the area of the contact;
it is 5th the deformation of the contact of the surface of the hammer;
6 greatest contact pressure on the area of the contact;
7 equivalent stress at the dangerous point;
the radius of curvature of fist against the contact point is eighth;
9 pressure angle;
10 the angular position of contact point relative to the beginning the counting of cam profile (before the degrees);
11- rate of roller across the hammer;
12- energy, accumulated by the cam pair;
13
14 current number of the interval of the profile of the hammer;
15- value, reciprocal to the given modulus of elasticity of the hammer;
16 value, reciprocal to the given modulus of elasticity of the roller;
17- the initial rigidity
18- the actual deformation

ELEMENTS OF STATE VECTOR:
1 energy, accumulated by the cam pair;
the angle of rotation of the hammer is 2nd
3- the assumed interval of the contact of hammer and roller
4 the equilibrium contact deformation
it is 5th
6
7 angle of the contact
it is eighth the state of contact against the previous successful step
9 rigidity of contact against the previous successful step

1.2. DVAK - Induction motor with the characteristic about Closs's formula

Induction motor with the characteristic about Closs's formula.
NAME: Model of asynchronous electric motor
by the static mechanical characteristic
about the precise formula of Closs

FIELD OF APPLICATION : Mechanics.

DEGREES OF FREEDOM:
1 rotatory of the shaft of engine.

PARAMETERS:
1 synchronous frequency of the rotation of engine, r/min
(>0 with the counterclockwise revolution,
<0 with the clockwise revolution)
it is 2nd the nominal frequency of rotation, r/min (> 0)
3- the nominal yield of engine, kW (> 0)
4 ratio of maximum moment to the nominal (>= 1.5)
it is 5th the relation of the resistance of the chains of stator-rotor unit
(>=0 in the absence of data =0)
6 multiplicity of an increase in the critical slip during the introduction
additional resistance beside the chain of rotor (>= 1)
7 moment of the inertia of the rotor of engine, the kg*m^2
it is eighth the initial frequency of rotation, r/min (>1e10 not of mouths)

ELEMENTS OF THE WORKING VECTOR:
1 the mechanical work, perfected by the electric motor;
the moment, developed as far as the engine is 2nd,
3- the current slip
4 the synchronous speed
it is 5th the critical slip
6 coefficient before the formula of the moment
7 direction of rotation

1.3. KULDR- Disk kulak with the roller pusher

Disk kulak with the roller pusher
NAME: Disk kulak with the roller pusher

FIELD OF APPLICATION : Mechanics.

DEGREES OF FREEDOM:
1 progressive of the axis of hammer across the axis OX;
it is 2nd progressive of the axis of hammer across the axis OY;
3- rotatory of hammer around its own axis;
4 progressive of the axis of roller across the axis OX;
it is 5th progressive of the axis of roller across the axis OY;
6 rotatory of roller around its own axis;

PARAMETERS:
1 the origin coordinate of the axis of hammer across the x axis
it is 2nd the origin coordinate of the axis of hammer across the y axis
3- the initial angle of rotation of fist (before deg.)
4 thickness of the fist (> 0)
the modulus of elasticity of the material of the fist (> 0) is 5th
6 Poisson ratio of the material of fist (> 0 I < 1)
7 material density of the fist (>= 0)

it is eighth the origin coordinate of the axis of roller across the x axis
9 the origin coordinate of the axis of roller across the y axis
10 radius of the roller (> 0)
11- modulus of elasticity of the material of the roller (> 0)
12- Poisson ratio of the material of roller (> 0 I < 1)
13- mass of the roller (>= 0)
14 moment of the inertia of the roller (>= 0)
15- frictional drag coefficient (>= 0)
16 coefficient of rolling friction (>= 0 I
<= 0.1*Rroll)
17- condition of the presence of gravitational force (>= 0 I of <=1)

Coordinates the radius-the vector of the profile of hammer (j=1, N):
2*j+16- angular coordinate j-the point of the profile of hammer (before deg.)
2*j+17- radius-vector j-the point of the profile of the hammer
---
Notes:
1) it will assume. the reference direction of the angles - counterclockwise;
2) the angle of rotation of fist is equal down the angle of deflection of the zero line
(reference line of cam profile) from the axis OX;
3) a minimum quantity of points of cam profile - four;
4) the radius part of the profile must be assigned by two extreme
by the points - A QUANTITY OF RADIUS SECTIONS IS NOT MORE THAN 5!!!
5) the angle between the adjacent sections of cam profile - not less than 120
and not more than 180 deg (with exception of radius sections);
6) with the task of the points of cam profile angular coordinate always
it is non-negative and increases from the point to the point, the value

the radius-vector it is always non-negative;
7) cam profile is considered closed - the last given point
profile automatically it is connected with the first.
8) the profile of hammer must have at least one radius section,
in this case the initial point of profile must correspond to the beginning
what-or radius section, and the latter - to the end of the same
radius section.
9) the model of element limits the step of integration by value,
allowing the turning of fist against the step not more than on 90 deg.

ELEMENTS OF THE WORKING VECTOR:
(Signs of efforts and speeds are given before the projections beyond such local
the system of coordinates OX'Y' of hammer, before which axis OY'
it is directed across the external normal to the hammer, and axis OX' is directed
along the tangent to the hammer it defends from the axis OY' at angle of 90
deg., calculated between the axis OY' against the hour of pointer)

1 normal force down the hammer against the contact point;
it is 2nd tangential force (frictional force) down the hammer;
3- total moment of the frictional forces of rolling and slip
relative to the rotational axis of the fist;
4 half-width of the area of the contact;
it is 5th the deformation of the contact of the surface of the hammer;
6 greatest contact pressure on the area of the contact;
7 equivalent stress at the dangerous point;
is eighth the radius of curvature of fist before contact point;
9 pressure angle;
10 the angular position of contact point relative to the beginning
the counting of cam profile (before the degrees);
11- rate of roller across the hammer;
12- rate of the displacement of contact point by means of the hammer;
13- energy, accumulated by the cam pair;
14 current number of the interval of the profile of the hammer;

15- mass of the hammer;
16 moment of the inertia of the hammer;
17- initial angular position of the center of the masses;
18- radius-vector of the center of the masses;
19 value, reciprocal to the given modulus of elasticity of the hammer;
20- value, reciprocal to the given modulus of elasticity of the roller;
21 - the true deformation
22- flag of the state

ELEMENTS OF STATE VECTOR:
1 energy, accumulated by the cam pair;
the angle of rotation of the hammer is 2nd
3- the assumed interval of the contact of hammer and roller
4 slip rate
it is 5th the speed of the rolling
6 rate of the displacement of the contact
7 angle of the contact

1.4. KULDRZ - Disk kulak with the roller pusher (profile-theoretical, without the detachment)

Disk kulak with the roller pusher (profile-theoretical, without the detachment)
NAME: Disk kulak with the roller pusher
the theoretical profile of the hammer is prescribed
the kinematic closing of the profile is provide ford

FIELD OF APPLICATION: Mechanics.

DEGREES OF FREEDOM:
1 progressive of the axis of hammer across the axis OX;
it is 2nd progressive of the axis of hammer across the axis OY;
3- rotatory of hammer around its own axis;
4 progressive of the axis of roller across the axis OX;
it is 5th progressive of the axis of roller across the axis OY;
6 rotatory of roller around its own axis;

PARAMETERS:
1 the origin coordinate of the axis of hammer across the x axis
it is 2nd the origin coordinate of the axis of hammer across the y axis
3- the initial angle of rotation of fist (before deg.)
4 thickness of the fist (> 0)
the modulus of elasticity of the material of the fist (> 0) is 5th
6 Poisson ratio of the material of fist (> 0 I < 1)
7 material density of the fist (>= 0)

it is eighth the origin coordinate of the axis of roller across the x axis
9 the origin coordinate of the axis of roller across the y axis
10 radius of the roller (> 0)
11- modulus of elasticity of the material of the roller (> 0)
12- Poisson ratio of the material of roller (> 0 I < 1)
13- mass of the roller (>= 0)
14 moment of the inertia of the roller (>= 0)
15- frictional drag coefficient (>= 0)
16 coefficient of rolling friction (>= 0 I
<= 0.1*Rroll)
17- condition of the presence of gravitational force (>= 0 I of <=1)

Coordinates the radius-the vector of the profile of hammer (j=1, N):
2*j+16- angular coordinate j-the point of the profile of hammer (before deg.)
2*j+17- radius-vector j-the point of the profile of the hammer
---
Notes:
1) it will assume. the reference direction of the angles - counterclockwise;
2) the angle of rotation of fist is equal down the angle of deflection of the zero line (reference line of cam profile) from the axis OX;
3) a minimum quantity of points of cam profile - four;
4) the radius part of the profile must be assigned by two extreme by the points - A QUANTITY OF RADIUS SECTIONS IS NOT MORE THAN 5!!!

5) the angle between the adjacent sections of cam profile - not less than 120
and not more than 180 deg (with exception of radius sections);
6) with the task of the points of cam profile angular coordinate always
it is non-negative and increases from the point to the point, the value
the radius-vector it is always non-negative;
7) cam profile is considered closed - the last given point
profile automatically it is connected with the first.
8) the profile of hammer must have at least one radius section,
in this case the initial point of profile must correspond to the beginning
what-or radius section, and the latter - to the end of the same
radius section.
9) the model of element limits the step of integration by value,
allowing the turning of fist against the step not more than on 90 deg.

ELEMENTS OF THE WORKING VECTOR:
(Signs of efforts and speeds are given before the projections beyond such local
the system of coordinates OX'Y' of hammer, before which axis OY'
it is directed across the external normal to the hammer, and axis OX' is directed
along the tangent to the hammer it defends from the axis OY' at angle of 90
deg., calculated between the axis OY' against the hour of pointer)

1 normal force down the hammer against the contact point;
it is 2nd tangential force (frictional force) down the hammer;
3- total moment of the frictional forces of rolling and slip
relative to the rotational axis of the fist;
4 half-width of the area of the contact;
it is 5th the deformation of the contact of the surface of the hammer;
6 greatest contact pressure on the area of the contact;
7 equivalent stress at the dangerous point;
is eighth the radius of curvature of fist before contact point;
9 pressure angle;
10 the angular position of contact point relative to the beginning
the counting of cam profile (before the degrees);
11- rate of roller across the hammer;
12- rate of the displacement of contact point by means of the hammer;
13- energy, accumulated by the cam pair;
14 current number of the interval of the profile of the hammer;

15- mass of the hammer;
16 moment of the inertia of the hammer;
17- initial angular position of the center of the masses;
18- radius-vector of the center of the masses;
19 value, reciprocal to the given modulus of elasticity of the hammer;
20- value, reciprocal to the given modulus of elasticity of the roller;
21 - the true deformation
22- flag of the state

ELEMENTS OF STATE VECTOR:
1 energy, accumulated by the cam pair;
the angle of rotation of the hammer is 2nd
3- the assumed interval of the contact of hammer and roller

4 slip rate
it is 5th the speed of the rolling
6 rate of the displacement of the contact
7 angle of the contact

1.5. MJ2EG - Flat inertia element with displaced position of the center of masses and gravitational force

Flat inertia element with displaced position of the center of masses and gravitational force

NAME: Flat inertia element with the displaced position
the center of masses relative to the point A of body, with which
the degrees of freedom of plane motion are connected.
Gravitational force along one of the axes is considered.

FIELD OF APPLICATION : Mechanics.

DEGREES OF FREEDOM:
1,2 - progressive points A across the axes of the X, Y;
3- rotatory of point A.

PARAMETERS:
1,2 - the origin coordinates of point A across the axes of the X, Y;
3,4 - the origin coordinates of the center of masses across the axes of the X, Y;
it is 5th the mass of the body (>= 0);
6 moment of the inertia of body relative to the axis, which passes
through the center of masses it is perpendicular down the plane
the motion (>=0).
7 number of the coordinate of axis on which acts gravitational force
(1-abscissas, 2-ordinates, 0 or 3-it does not act (z coordinates)

ELEMENTS OF THE WORKING VECTOR:
1,2 - the displacement of the center of masses by means of the axes of the X, Y.

1.6. MJ2EGT - Flat inertia element with gravitational force, assigned tabular

Flat inertia element with gravitational force, assigned tabular
NAME: Flat inertia element with the displaced position
the center of masses relative to the point A of body, with which
the degrees of freedom of plane motion are connected.
Gravitational force along one of the axes is considered.
The inertia of element tabular depends on time.

FIELD OF APPLICATION : Mechanics.

DEGREES OF FREEDOM:
1,2 - progressive points A across the axes of the X, Y;
3- rotatory of point A.

PARAMETERS:
1,2 - the origin coordinates of point A across the axes of the X, Y;
3,4 - the origin coordinates of the center of masses across the axes of the X, Y;
it is 5th the initial mass of the body (>= 0);
6 initial moment of the inertia of body relative to the axis, which passes
through the center of masses it is perpendicular down the plane
the motion (>=0).
7 number of the coordinate of axis on which acts gravitational force
(1-abscissas, 2-ordinates, 0 or 3-it does not act (z coordinates)
8… 2N+7- the table, which assigns the dependence of the coefficient of the change
mass and the moment of inertia from the time.
An arbitrary quantity of points contains.
Each i-I point (i=1, N) is determined as far as the parameters :
2*i- moment of the time;
2*i+1- the value of coefficient for this moment
the time (>=0).

ELEMENTS OF THE WORKING VECTOR:
1,2 - the displacement of the center of masses by means of the axes of the X, Y.

NOTE.
1. for all points of table, except the first two and two
the latter, must be satisfied condition t (i) =< t (i+1).
For the first two and two last points t (i) < t (i+1).
2. must be prescribed as the minimum two points of table.
3. if the current model time exceeds last given one
before the table moment of the time or less than the first, the flowing
the value of the difference of accelerations is determined as far as the extrapolation
the nearest prescribed section.
4. model recommends to working program this value of the step
integration in order accurately to fall beside the salient points
the dependence of the inertia parameters beyond the time.

5. coefficient must be non-negative

1.7. MUFTL - Friction main clutch, controlled by the logical signal

Friction main clutch, controlled by the logical signal
NAME: Model of friction main clutch,
controlled by the logical signal

FIELD OF APPLICATION : Mechanics.

DEGREES OF FREEDOM:
1 rotatory (progressive) of the 1st element
it is 2nd rotatory (progressive) 2-GO of the element
3- control signal

PARAMETERS:
1 value of the maximum moment, transferred by the clutch
with the complete joining (>= 0)
it is 2nd the rigidity of clutch for the twisting (> 0)
3- the time of start down the complete joining (> 0)
4 tripping time down the breaking (> 0)
the moment of the inertia of the 1st element (>= 0) is 5th
6 moment of inertia 2-GO of the element (>= 0)

ELEMENTS OF THE WORKING VECTOR:
1 work lost in friction
the current moment, transferred by the clutch is 2nd,
3- the maximum current moment
4 the minimum preliminary displacement

1.8. NPLO - One-sided guides of the slip

One-sided guides of the slip
NAME: One-sided guides of the slip
with the clearance between the contact surfaces

FIELD OF APPLICATION: Mechanics

DEGREES OF FREEDOM:
1 progressive of the 1st element across the axis OX
it is 2nd progressive of the 1st element across the axis OY
3- progressive 2-GO of element across the axis OX
4 progressive 2-GO of element across the axis OY

PARAMETERS:
1 slope angle down to the axis OX (>= -360 and =<360)
the initial clearance (>=0) is 2nd
3- the coefficient of friction (>=0 and =<1)
4 rigidity of contact for the compression (CN>1E6)
it is 5th the rigidity of contact down the shift (>1E6 and =<CN)

ELEMENTS OF STATE VECTOR:
1 the current shearing strain

ELEMENTS OF THE WORKING VECTOR:
1 work lost in friction before the guides
it is 2nd normal force on the contact
3- frictional force
4 the minimum shearing strain
it is 5th the trigonometric functions of the angle

1.9. NPLV - Guiding 2d, that impede rotation around the axis of movement

Guiding 2d, that impede rotation around the axis of movement
NAME: the guides of slip,
impeding the relative
to the angular displacement of the contacting components
around the axis of the longitudinal travel
Initial clearance is closed with the positive angle
the turning of the 1st element relative to 2-GO

FIELD OF APPLICATION: Mechanics

DEGREES OF FREEDOM:
1 progressive of the 1st element of the connection
it is 2nd rotatory of the 1st element of the connection
3- progressive 2-GO of the element of the connection
4 rotatory 2-GO of the element of the connection

PARAMETERS:
1 the mean radius of connection, m (>0)
are 2nd the rotational play, rad (>=0)
3- the given coefficient of friction (>=0 and <=1)
4 given torsional stiffness of contact (>0)
N*m/rad
it is 5th the shear stiffness of contact, N/m (>0)

ELEMENTS OF STATE VECTOR:
1 the current shearing strain

ELEMENTS OF THE WORKING VECTOR:
1 relative angular displacement the 1 or of 2 surfaces
it is 2nd the minimum shearing strain
3- the given coefficient of the friction

1.10. NPR2D - Guides of slip on the plane

Guides of slip on the plane
NAME: Guides of slips, moving
in the plane,
ideally elastic, with the friction and the clearance,

FIELD OF APPLICATION : Mechanics.

DEGREES OF FREEDOM:
1 progressive of the center of slider before the direction of axis OX
it is 2nd progressive of the center of slider before the direction of axis OY
3- rotatory of the center of the slider
4 progressive of the center of guides before the direction of axis OX
it is 5th progressive of the center of guides before the direction of axis OY
6 rotatory of the center of the guides

PARAMETERS:
The local coordinate system is connected for the sake of the center of the slider
axis On - it is normal to the contact surface of the guides
axis Ot - it is directed along the contact surface
and it is turned down the angle, which coincides for the sake of the angle
the surface slope of guides.
Angle of the slope of guides at the initial moment of the time
it coincides for the sake of the vector angle, which connects the center
guiding with the center of the slider
The geometric centers of slider and guides coincide
with their centers of the masses

1 the origin coordinate of the center of slider across the axis OX
it is 2nd the origin coordinate of the center of slider across the axis OY
3- the origin coordinate of the center of guides across the axis OX
4 the origin coordinate of the center of guides across the axis OY
is 5th the initial angle of the slope of guides to the axis OX
(it is used only with the agreement of the initial
the coordinates of the centers of guides and slider)
(>= -360 and =<360)
6 width of slider (>0)
7 length of slider (L>0)
initial clearance to the right contact is eighth
the surface of the guides (>=0 and <=0.08*L)
9 initial clearance to the left contact
the surface of the guides (>=0 and <=0.08*L)
10 coefficient of friction (>=0 and =<1)
11- normal contact rigidity (>=1e6)

ELEMENTS OF THE WORKING VECTOR:
1 loss down the friction before the element
it is 2nd the resulting normal force before right guides
3- the resulting normal force before left guides

4 max. pressure per unit of width before right guides
is 5th max. pressure per unit of width before the left guides
6 frictional force before the left guides
7 frictional force before right guides
the angle of rotation of guides (degrees) is eighth
9 normal displacement of upper t of the axis of the symmetry of the slider
10 normal displacement of lower t of the axis of the symmetry of the slider
11- displacement of the slider of lengthwise guides
12- the long line of contact on right guides
13- the long line of contact on the left guides

1.11. PD - One-dimensional elastic-the wrought billet

One-dimensional elastic-the wrought billet
NAME: One-dimensional elastic-the wrought billet
c is piecewise-by the linear dependence of effort beyond the deformation
and by power feed of the new billets

FIELD OF APPLICATION: Mechanics

DEGREES OF FREEDOM:
1 progressive 1-the oh deforming surface
it is 2nd progressive 2-the oh deforming surface

PARAMETERS:
1 time of the supply of the first billet (TB>-TC)
is 2nd the cycle of the supply of new billets (TC>0)
3- the displacement of the deforming surfaces (SD0>=0)
throughout the beginning of the deformation
4 rigidity of billet during the deformation (CS>0)
(elastic constituting)
5. - the coordinate of the points of the dependence of force beyond
deformation before the following sequence:
5+2* (i-1) - deformation (D1=0, Di>=Di-1)
6+2* (i-1) - force (Pi>=0)
is i-th the number of point (i>=2)
the vertical sections of a drop in the force
the destruction of the billet is considered moment
OBSERVATIONS
Billet is deformed with positive displacement 1-y
surface relative to 2-y

ELEMENTS OF STATE VECTOR:
1 time of the appearance of the current billet TB
it is 2nd the displacement of the beginning of elastic deformation D0
3- the displacement of the beginning of plastic deformation D1
4 displacement of the destruction of billet DR
is 5th the number of the current section IU
6 DEF
7 P
A is eighth
9 SIGN OF THE VERSION
ELEMENTS OF THE WORKING VECTOR:
1 work of deformation before the cycle
it is 2nd the accumulated plastic deformation of the billet
3- the displacement, with which begins the destruction
4 work on the previous cycle
SPECIAL CASES
The algorithm of working model assumes the appearance of the new

NONDEFORMED billet through the time interval, equal cycle time.
If at this moment the distance between those deforming by surfaces it proves to be insufficient, occurs emergency stop with the delivery of diagnostic communication.

1.12. PKULDR - Shaping plate cam with the roller pusher

Shaping plate cam with the roller pusher
NAME: Compiling the file of the coordinates of the theoretical profile
plate cam with the roller pusher

FIELD OF APPLICATION : Mechanics.

DEGREES OF FREEDOM:
1 progressive of the axis of hammer across the axis OX;
it is 2nd progressive of the axis of hammer across the axis OY;
3- rotatory of hammer around its own axis;
4 progressive of the axis of roller across the axis OX;
it is 5th progressive of the axis of roller across the axis OY;

PARAMETERS:
1 the origin coordinate of the axis of hammer across the x axis
it is 2nd the origin coordinate of the axis of hammer across the y axis
3- the origin coordinate of the axis of roller across the x axis
4 the origin coordinate of the axis of roller across the y axis
is 5th the number n of the file of the profile Of kULAKn.PRF (1… 9)
6 step of the conclusion of the points of profile (degrees) (>=0.5, =<30)
7,8 - the interval of the angle of rotations of hammer (degrees) with which
is accomplished shaping (7 Fmin, it is eighth Fmax)
(Fmin<Fmax; abs (Fmax-Fmin) <=360)
!! With the negative direction of rotation of the hammer
the value of the interval of angles must be negative

Notes:
1) it will assume. the reference direction of the angles - counterclockwise;
2) the angle of rotation of fist is equal down the angle of deflection of the zero line (reference line of cam profile) from the axis OX;

ELEMENTS OF THE WORKING VECTOR:

ELEMENTS OF STATE VECTOR:
1 angle of rotation of hammer from the beginning of the calculation
is 2nd a radius the vector of point (multiple)
3- the angle of profile (multiple)
4 angle of rotation of hammer on the cyclogram
is 5th angle a radius of the vector of point at the moment of the contact
6 flag of the conclusion of the point
7 derivative is the radius-the vector
radius of curvature is eighth
9 angle of normal to the profile
10 angle of the direction of the speed
11- pressure angle
12- counter of the points of the profile

13- the second derivative is the radius-the vector

1.13. PODP - Step-bearing

Step-bearing
NAME: One-sided step-bearing of slip,
impeding the relative positive
to the displacement of the 1st element of the contacting components
relative to 2-GO along the axis of the longitudinal travel
and reproducing of the property of dry friction with
the relative turning of the elements

FIELD OF APPLICATION: Mechanics

DEGREES OF FREEDOM:
1 progressive of the 1st element of the connection
it is 2nd rotatory of the 1st element of the connection
3- progressive 2-GO of the element of the connection
4 rotatory 2-GO of the element of the connection

PARAMETERS:
1 the mean radius of connection, m (>0)
are 2nd the initial clearance, m (>=0)
3- the given coefficient of friction (>=0 and <=1)
4 given normal rigidity of contact (>0)
N/m
it is 5th the given torsional stiffness of contact (>0)
N*m/rad

ELEMENTS OF STATE VECTOR:
1 the current shearing strain

ELEMENTS OF THE WORKING VECTOR:
1 the minimum shearing strain

1.14. PRDT - Transmission by friction, the unified model

Transmission by friction, the unified model
NAME: Model of transmission by the friction
rotatory and (or) progressive displacements,
characterizing by gear ratio,
efficiency, by elastic slip (it is proportional
to moment) and by the inertia properties

FIELD OF APPLICATION : Mechanics.

DEGREES OF FREEDOM:
1 rotatory (progressive) of the 1st element
it is 2nd rotatory (progressive) 2-GO of the element
3- the given deformation

PARAMETERS:
1 value of gear ratio
(>0 or < 0).
nominal moment (force) down 1 is 2nd-m the element
(>= 0).
3- efficiency with the nominal moment
(>0 and =< 1).
4 slip with the nominal moment
(>0 and =< 1-efficiency)
it is 5th the rigidity of transmission, given [k]
1-mu to element. (>= 0).
6 moment of the inertia (mass) of the 1st element of the transmission
(>= 0).
7 moment of inertia (mass) 2-GO of the element of the transmission
(>= 0).

ELEMENTS OF THE WORKING VECTOR:
1 energy, spent by the transmission
the current transmission efficiency is 2nd
3- the current slip of the transmission
4 moment (force) on the first element without the account
by inertia component
it is 5th the minimum contact deformation
6 moment of the idling

1.15. S01PRF - Law of inclined sinusoid for shaping of the hammers

Law of inclined sinusoid for shaping of the hammers
NAME: Source of mechanical force (moment), which ensures
a difference in the displacements between two points according to the law
inclined sinusoid, depending on angle of rotation
the hammer, which works before the regime
"the delay time-the forward stroke-the delay time-the back stroke-delay time"

FIELD OF APPLICATION : Shaping hammers.

DEGREES OF FREEDOM:
1,2 - degree of freedom, a difference in the displacements between which
the model is assigned;
3- rotatory of hammer around its own axis;

PARAMETERS:
1 amplitude of difference displacement, meters (0>A<0)
it is 2nd the cycle angle of the beginning of forward stroke, the degrees
(-360 <Alf1<360)
3- the phase angle of the duration of the forward stroke
(0 <Fi1<360)
4 phase angle of the duration of the delay time
(Fi2>0, 0 <Fi1+Fi2<360)
The phase angle of the duration of the back stroke is 5th
(Fi3>0, 0 <Fi1+Fi2+Fi3<360)
6 coefficient of inclined sinusoid against the forward stroke
abs (B1) <1
7 coefficient of inclined sinusoid against the back stroke
abs (B2) <1
constant of proportionality between the effort is eighth,
by the generatable element, and by deviation from
the prescribed displacement (KE > 0).
9 direction of rotation of fist (+1 against the hour
-1 on the hour)
9 maximum error of the task of the displacement
(0 < ERRM < of 0.01*abs (A))
WORKING VECTOR:
1 given value of the displacement;
it is 2nd the difference between the actual and given value
displacement.

NOTE:
1. program automatically recounts angles beside the radians.
2. change in the difference of displacements is described by the dependence:
DS = A0 the initial delay time
DS = OF A0+A * (z-(1/2*pi) *sin (2*pi*z)), against the forward stroke
k=z-(B1/2*pi) *sin (2*pi*z), k= (alf-alf2) /fi1
DS = OF A0+The second delay time
-(1/2*pi) *sin (2*pi*z)), against the back stroke

k=z-(B1/2*pi) of *sin (2*pi*z), k=1- (alf-alf4) /fi3

3. at the initial moment of time a difference in the displacements is equal to zero
   Based on this program automatically calculates conditions
   coefficient A0

1.16. S02PRF - Law Neklutin for shaping of the hammers

Law Neklutin for shaping of the hammers
NAME: Source of mechanical force (moment), which ensures
a difference in the displacements between two points according to the law Neklutin (modified trapezoid),
depending on angle of rotation
the hammer, which works before the regime
"the delay time-the forward stroke-the delay time-the back stroke-delay time"

FIELD OF APPLICATION : Shaping hammers.

DEGREES OF FREEDOM:
1,2 - degree of freedom, a difference in the displacements between which the model is assigned;
3- rotatory of hammer around its own axis;

PARAMETERS:
1 amplitude of a difference in the displacements, meters (0>A<0)
it is 2nd the cycle angle of the beginning of forward stroke, the degrees (-360 <Alf1<360)
3- the phase angle of the duration of the forward stroke (-360 <Fi1 of <360)
4 phase angle of the duration of the delay time (Fi2>0, 0 <Fi1+Fi2<360)
The phase angle of the duration of the back stroke is 5th (Fi3>0, 0 <Fi1+Fi2+Fi3<360)
6 relative duration of the front of the trapezoid against the forward stroke (0 <= M1 <= 0.25)
7 relative duration of the front of the trapezoid against the back stroke (0 <= M2 <= 0.25)
constant of proportionality between the effort is eighth, by the generatable element, and by deviation from the prescribed displacement (KE > 0).
9 direction of rotation of fist (+1 against the hour -1 on the hour)
9 maximum error of the task of the displacement (0 < ERRM < of 0.01*abs (A))
WORKING VECTOR:
1 given value of the displacement;
it is 2nd the difference between the actual and given value displacement.

NOTE:
1. program automatically recounts angles beside the radians.
2. change in the difference of displacements is described by the dependence:
DS = A0 the initial delay time
DS = OF A0+A * KS (k), k= (alf-alf2) /fi1 against the forward stroke
DS = OF A0+The second delay time
DS = A0+A * KS (k), k=1- (alf-alf4) /fi3 against the back stroke

3. at the initial moment of time difference displacement is equal to zero Based on this program automatically calculates conditions coefficient A0
4. model recommends to working program this value of the step integration in order accurately to fall beside the points of the cyclic angles.

1.17. SHARZ - Cylindrical joint on the plane

Cylindrical joint on the plane
NAME: Cylindrical joint, moving in the plane,
ideally elastic, with the friction and the clearance

FIELD OF APPLICATION : Mechanics.

DEGREES OF FREEDOM:
1 progressive before the direction of the axis OX of the finger joint.
it is 2nd progressive before the direction of the axis OY of the finger joint.
3- rotatory of the finger of joint.
4 progressive before the direction of the axis OX of the ring joint.
it is 5th progressive before the direction of the axis OY of the ring joint.
6 rotatory of the ring of joint.

PARAMETERS:
1 diameter of the joint (> 0)
the coefficient of the friction (>= 0) is 2nd
3- the clearance (>= 0)
4 normal contact rigidity (>= 0)

ELEMENTS OF THE WORKING VECTOR:
1 energy, spent by the element
it is 2nd normal force on the contact
3- frictional force on the contact
4 current deformation (>0) or clearance (<0)
the current angle of the contact is 5th
6 projection of the relative displacement of axes on OX
7 projection of the relative displacement of axes on OY

1.18. SV2DK - 2d elastic constraint on the progressive and rotatory coordinates

2d elastic constraint on the progressive and rotatory coordinates
NAME: Elastic constraint of two points of plane on
to the progressive and rotatory coordinates
with the task to rigidity of the connection

FIELD OF APPLICATION : Mechanics

DEGREES OF FREEDOM:
1,2 - progressive points A across the X-axes and ordinates
3- rotatory of point A around the z-axis
4, it is 5th progressive points B across the X-axes and ordinates
6 rotatory points B around the z-axis

PARAMETERS:
1,2 - the initial coordinate of point A across the X-axes and ordinates;
3, 4 initial coordinate of point B across the X-axes and ordinates;
it is 5th transverse pliability (normal of axis of communication) (> 0);
6 longitudinal pliability (along the axis of communication) (> 0);

ELEMENTS OF THE WORKING VECTOR:
Power factors before the local system of coordinates of the girder:
1 the longitudinal compressive force ;
it is 2nd transverse ;
3- the bending moment at point A ;
4 bending moment at point B ;
Deformations before THE LCS of the girder:
it is 5th axial dilitational strain-the compression
6 the lateral deformation
7 the angular strain
is eighth angle of rotation THE LCS

1.19. SV3DK - 3d elastic constraint on the progressive and rotatory coordinates

3d elastic constraint on the progressive and rotatory coordinates
NAME: Elastic constraint of two points of space on
to the progressive and rotatory coordinates
with the task to rigidity of the connection

LIMITATIONS: Model does not contain the inertia parameters

FIELD OF APPLICATION: Mechanics.

DEGREES OF FREEDOM:
1,2, 3- progressive points A across the axes OX, OY, OZ;
4, 5, 6 rotatory points A around the axes OX, OY, OZ;
7, 8, 9 progressive points B across the axes OX, OY, OZ;
10,11,12 - rotatory points B around the axes OX, OY, OZ.
13,14 - the scalar parts of the quaternions

PARAMETERS:
1,2, 3- of the initial coordinate of point A across the axes OX, OY, OZ;
4, 5, 6 initial coordinate of point B across the axes OX, OY, OZ;
7, 8, 9 initial coordinate of the auxiliary point D, which determines
together with the points A and B the first principal plane
the inertia of cross section (plane of the arrangement
the local axis of X');
10 transverse pliability before the direction of axis x' (> 0);
11- transverse pliability before the direction of axis the y (> 0);
12- torsional pliability around the axis z' (> 0);
13- longitudinal pliability before the direction of axis z' (> 0);

ELEMENTS OF THE WORKING VECTOR:
Power factors before the local system of coordinates (ЛСК) of the girder:
1 transverse before p. A across the axis X';
it is 2nd transverse before p. A across the axis Y';
3- longitudinal force before the p. A;
4 bending moment before p. A relative to axis X';
is 5th the bending moment before p. A relative to axis Y';
6 torque before the p. A;
7 bending moment before p. B relative to axis X';
is eighth the bending moment before p. B relative to axis Y';
9 torque before p. B.
Deformations before THE LCS of the girder:
10 axial dilitational strain-the compression;
11- torsion angle across the axis of the girder;
12- bending deformation before p. A relative to axis X';
13- bending deformation before p. A relative to axis Y';
14 bending deformation before p. B relative to axis X';
15- bending deformation before p. B relative to the axis of Y'.

Notes:
The axis of girder (by axis Z' LCS) is considered the ray, which emerges based on p. A on
to direction to the point B. under the bending deformation relatively
of axis X' or Y' LCS is understood the tangent of angle of deflection
the projection of the elastic line of girder beyond the plane, perpendicular
the corresponding axis LCS, from the axis of girder.

Other fixed elements of the working vector:
16,17,18 - the direction cosines of axis X' THE LCS of the girder;
19,20 - deviation from 1 value of those scaling
the coefficients of angular degrees of freedom
for the points A and B.

Model uses the stiffness matrix of girder, which corresponds similar,
to the position of the local system of coordinates (JICK) of the girder, when z axis
LCS it penetrates the ends of the girder. With this selection LCS the matrix
of flexural rigidity it is written only relative to the angular strain
the ends of the girder. MODEL IS ALTERED FROM BAL3DJ

1.20. TORML - Friction brake, controlled by the logical signal

Friction brake, controlled by the logical signal
NAME: Model of friction brake,
disconnected by the logical signal
(it is included in the initial moment of time)

FIELD OF APPLICATION : Mechanics.

DEGREES OF FREEDOM:
1 rotatory (progressive) of the 1st element
it is 2nd rotatory (progressive) 2-GO of the element
3- control signal

PARAMETERS:
1 value of the maximum braking moment
with the complete joining (>= 0)
it is 2nd the rigidity of brake for the twisting (> 0)
3- the time of the start (> 0)
4 tripping time (> 0)
the moment of the inertia of the 1st element (>= 0) is 5th
6 moment of inertia 2-GO of the element (>= 0)

ELEMENTS OF THE WORKING VECTOR:
1 work lost in friction
the current moment, transferred by the brake is 2nd,
3- the maximum current moment
4 the minimum preliminary displacement

1.21. TRANS1 - Translation of motion by 1d-1d with the losses of force and speed

Translation of motion by 1d-1d with the losses of force and speed
NAME: Model of the transmission of rotatory or
progressive displacements from the 1st element to the 2nd,
characterizing by gear ratio,
by the losses of the transferred force (efficiency),
by the losses of the transferred speed (slip),
by the inertia properties

FIELD OF APPLICATION : Mechanics.

DEGREES OF FREEDOM:
1 rotatory (progressive) of the 1st element
it is 2nd rotatory (progressive) 2-GO of the element
3- the given deformation

PARAMETERS:
1 gear ratio
(if <0, then the direction of speed down 2-m
element oppositely 1-mu)
nominal moment (force) down 1 is 2nd-m the element (> 0)
3- efficiency with the nominal moment (>0 and =< 1)
(is determined the constant component of the losses of force)
4 slip with the nominal moment (>=0 and =< 1-efficiency)
(proportional down the transferred force)
it is 5th the rigidity, led down 1-mu to the element (> 0)
6 moment of the inertia (mass) of the 1st element of the transmission (>= 0)
7 moment of inertia (mass) 2-GO of the element of the transmission (>= 0)

ELEMENTS OF THE WORKING VECTOR:
1 energy, spent by the transmission
the current transmission efficiency is 2nd
3- the current slip of the transmission
4 moment (force) on the first element without the account
by inertia component
it is 5th the minimum contact deformation
6 moment of the idling

1.22. VINT - Helical gear 2d

Helical gear 2d
NAME: The helical gear
with the clearance between the turns

FIELD OF APPLICATION: Mechanics

DEGREES OF FREEDOM:
1 progressive of the screw
it is 2nd rotatory of the screw
3- progressive of the nut
4 rotatory of the nut

PARAMETERS:
1 average thread diameter (D>0)
is 2nd flight (H<+-RLMAX)
the right-hand thread Of h>0: with the fixed nut
the rotation of screw before the positive direction
(against to hour hand)
the positive displacement is caused
(screw it is reversed from the nut)
3- the angle of the slope of working profile, degrees (0<ALR<90)
4 angle of the slope of nonworking profile (0<ALN<90)
is 5th general clearance (DEL>=0)
6 initial clearance between the working profile (0<=DR<=DEL)
screw and the nut
7 coefficient of friction (0<=K<=1)
it is eighth the rigidity of contact for the compression (CN>0)
9 rigidity of contact down the shift (CTM>0)

ELEMENTS OF STATE VECTOR:
1 current shearing strain of the turns

ELEMENTS OF THE WORKING VECTOR:
1 normal force before the fillets of screw
it is 2nd frictional force before the thread
3- the minimum shearing strain of the turns
4 initial clearance across the nonworking profile
the given coefficient of friction across the working profile is 5th
6 given coefficient of friction across the nonworking profile
7 the mean radius of the thread
it is eighth the trigonometric functions of the undercut