SURFACE PROFILING METHOD OF THE DISK CUTTER OF THE FEMALE ROTOR FROM THE SCREW COMPRESSOR COMPONENT

Camelia Popa, Virgil Teodor, Ionuţ Popa, Nicolae Oancea

"Dunărea de Jos" University of Galaţi
virgil.teodor@ugal.ro

ABSTRACT

The screw compressor rotors are bounded by cylindrical helical surfaces, with constant pitch. The generation of these surfaces is possible to be done using disk cutter, whose peripheral surfaces are revolution surfaces.

This paper proposes a method and an algorithm for profiling primary surfaces of the disk cutter, mutually enveloping with the helical surfaces of the rotor of the screw compressor.

The algorithm proposes the substitution of the transverse profiles of the rotor by Bézier polynomials.

KEYWORDS: helical surfaces, Bézier polynomial, meshing surfaces, disk cutter

1. Introduction

The profiling problem of disk cutter, tools bounded with revolution surfaces, is according to fundamental theorems of enveloping surfaces.

In some situations, such as screw compressor rotors, due to the complexity of the shape and of the parametric equations, the shape to be obtained is difficult to handle.

The frontal profile of the rotors to be generated using the rack generating, can be realized by the envelope method.

2. The profile generation of the disk cutter

The helical surfaces of screw compressors, male and female, are cylindrical helical surfaces with constant pitch.

Generating these types of surfaces is achieved by milling (grinding) with tools bounded by surfaces of revolution like disk cutter type, Figure 1.

Coordinates systems are defined:

- XYZ is the relative system to which is defined the surface of the helicoidal lobe to be generated (Z axis superposed to the rotor axis $\vec{V}$);
- $X_sY_sZ_s$ - global system associated to disk cutter (Z_s axis superposed of the disc cutter axis $\vec{A}$).

The axes $\vec{A}$ and $\vec{V}$ admit as common perpendicular the axis X (X_s). The distance between the two axes, $\vec{V}$ and $\vec{A}$, is denoted by a.

It is also noted α the angle between the axes Z and Z_s, see Figure 1.

Kinematics generation process involves the following movements:

- *I, II* - the movement of the helical screw workpiece to be generated, defined by helical parameter p_1 and axis $\vec{V}$, for the male rotor (right helix), respectively, p_2 female rotor (left helix);
- *III* - the rotation of disk cutter (cutting movement).

The peripheral surface of the disk cutter is determined as an envelope to each helical rotor to be generated.

The helical surfaces of the female rotor can be known by:

- direct measurement of the points on the generator, performed on a 3D measuring machine, if there is a physical rotor;
- the analytical forms of the rotor composite generator;
- the substitution of the generators rotor, in cross section, by Bézier polynomials of inferior degree, generated through a known small number of points (3 or 4 points).

3. Helical surfaces of the female rotor lobes

It is considered that the transverse profile of rotors is the result of enveloping with generating rack (the shape of the generating rack satisfies the specific requirements of a screw compressor rotor construction: no singular points on the profile, asymmetry of the profile generator, meshing line closed and with minimum length).

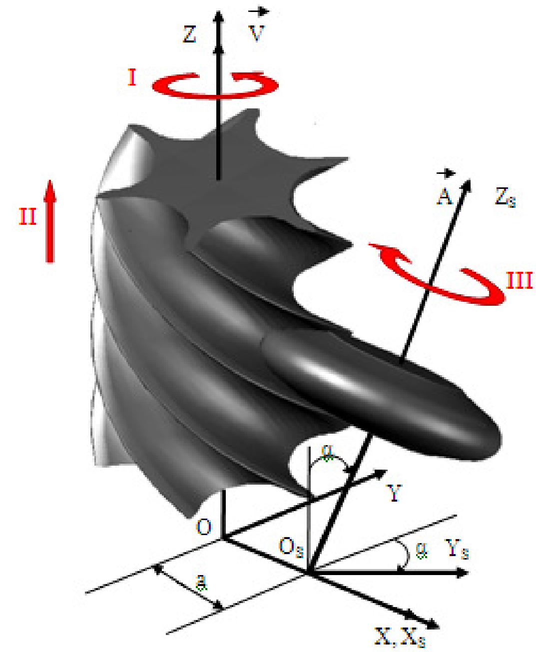

Fig. 1. *The relative position of the rotor and disk cutter to be generated*

In Figure 2, is given the shape of the transverse profile of the generating rack, whose envelope is the cross section of the screw compressor rotors.

The selection of the generating rack should lead to forms in cross sections of the screw compressor rotor capable to ensure:

- a pronounced asymmetry of the profile shape in order to obtain a satisfactory flow [9];
- a closed meshing line between the compressor rotors in order to ensure the sealing in the compression chambers [9];
- a volume embedded between rotor lobes as low as possible;
- the absence of singular points on the transverse profiles;
- a better processing of the screw compressor rotors, by providing tools for generating profiles without discontinuities [8].

To define a complex profile of the generating rack, which consists of a basic set of profiles, see Table 1.

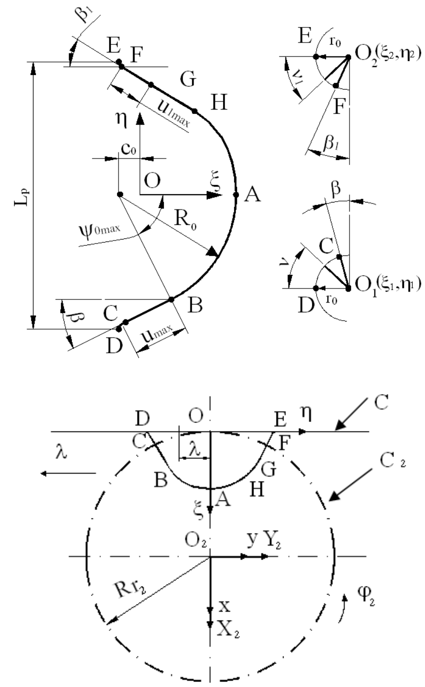

Fig. 2. *Crossing profile of the generating rack for generation of the female rotor*

● Determination of transverse profile of the female rotor

Crossing profile of female rotor is presented in Table 1.

Knowing the profile equations as transverse profile of the female rotor surface, can be determined the equations of the rotor lobes flanks, and hence, using one of the fundamental theorems of the enveloping surfaces [1], [2], [3] we can get the profile disk cutter to generate the gap between two successive lobes of the rotor.

However, we can imagine a solution based on tangents method [4], for which, the problem may be easier to apply.

•The shape of the helical surface substitute for female rotor

It is considered that the helical surface of the screw rotor compressor can be described as a set of cylindrical helical surfaces and constant step, knowing the cross section of the rotor.

Thus, giving the coordinates of a cross section of the female rotor in the form:

$$G=\left\|\begin{matrix} X_{2_1} & Y_{2_1} \\ X_{2_2} & Y_{2_2} \\ \vdots & \vdots \\ X_{2_n} & Y_{2_n} \end{matrix}\right\|, \qquad (1)$$

n is large enough.

Table 1. *The analytical model of crossing profile of the female rotor*

Sg.	Family of profiles	Meshing condition	Var. param.
$\overset{\frown}{AB}$	$\begin{cases} X_2 = R_0\cos(\psi+\varphi_2)-(R_{r_2}+c_0)\cdot\cos\varphi_2 - \\ -R_{r_2}\cdot\varphi_2\cdot\sin\varphi_2; \\ Y_2 = -R_0\sin(\psi+\varphi_2)+(R_{r_2}+c_0)\cdot\sin\varphi_2 - \\ -R_{r_2}\cdot\varphi_2\cdot\cos\varphi_2; \end{cases}$	$\varphi_2 = -\frac{c_0}{R_{r2}}\mathrm{tg}\psi$	$\psi_{min}=0$; $\psi_{max}=$ constructive
$\overline{BC}$	$\begin{cases} X_2 = -u\sin(\varphi_2+\psi_{max})+(\xi_B-R_{r_2})\cdot\cos\varphi_2 + \\ +(\eta_B-R_{r2}\cdot\varphi_2)\cdot\sin\varphi_2; \\ Y_2 = -u\cos(\varphi_2+\psi_{max})-(\xi_B-R_{r_2})\cdot\sin\varphi_2 + \\ +(\eta_B+R_{r2}\cdot\varphi_2)\cdot\cos\varphi_2; \end{cases}$	$\varphi_2 = \frac{-\frac{u}{\cos\psi_{max}}+\xi_B\cdot\mathrm{tg}\psi_{max}}{R_{r_2}} - \frac{\eta_B}{R_{r_2}}$	$u_{min}=0$; $u_{max}=$ determined $\beta = \frac{\pi}{2}-\psi_{max}$
$\overset{\frown}{CD}$	$\begin{cases} X_2 = -r_0\cos(\nu+\varphi_2)+(-R_{r_2}+\xi_{0_1})\cdot\cos\varphi_2 + \\ +(-R_{r_2}\cdot\varphi_2+\eta_{0_1})\cdot\sin\varphi_2; \\ Y_2 = r_0\sin(\nu+\varphi_2)-(-R_{r_2}+\xi_{0_1})\cdot\sin\varphi_2 + \\ +(-R_{r_2}\cdot\varphi_2+\eta_{0_1})\cdot\cos\varphi_2; \end{cases}$	$\varphi_2 = \frac{\xi_{0_1}\cdot\mathrm{tg}\nu+\eta_{0_1}}{R_{r_2}}$	$\upsilon_{min}=0$; $\upsilon_{max}=\frac{\pi}{2}-\beta$
$\overset{\frown}{EF}$	$\begin{cases} X_2 = -r_0\cdot\cos(\nu_1-\varphi_2)+\left(-R_{r_2}+\xi_{0_2}\right)\cdot\cos\varphi_2 + \\ +\left(-R_{r2}\cdot\varphi_2+\eta_{0_2}\right)\cdot\sin\varphi_2; \\ Y_2 = -r_0\cdot\sin(\nu_1-\varphi_2)-\left(-R_{r_2}+\xi_{0_2}\right)\cdot\sin\varphi_2 + \\ +\left(-R_{r2}\cdot\varphi_2-\eta_{0_2}\right)\cdot\cos\varphi_2; \end{cases}$	$\varphi_2 = \frac{\xi_{0_2}\cdot\mathrm{tg}\nu_1+\eta_{0_2}}{R_{r_2}}$	$\upsilon_{1min}=0$; $\upsilon_{1max}=\frac{\pi}{2}-\beta_1$
$\overline{FG}$	$\begin{cases} X_2 = u_1\cdot\cos(\varphi_2+\beta_1)+(\xi_F-R_{r_2})\cdot\cos\varphi_2 + \\ +(\eta_F-R_{r_2}\cdot\varphi_2)\cdot\sin\varphi_2; \\ Y_2 = -u_1\cdot\cos(\varphi_2+\beta_1)-(\xi_F-R_{r_2})\cdot\sin\varphi_2 + \\ +(\eta_F-R_{r_2}\cdot\varphi_2)\cdot\cos\varphi_2; \end{cases}$	$\varphi_2 = \frac{-\frac{u_1}{\sin\beta_1}+\xi_F\cdot\mathrm{ctg}\beta_1+\eta_F}{R_{r_2}}$	$u_{1min}=0$; $u_{1max}=$determ.
$\overset{\frown}{AH}$	$\begin{cases} X_2 = \left(\xi(\lambda_1)+R_{r_2}\right)\cdot\cos\varphi_2 - \\ -\left(\eta(\lambda_1)-R_{r2}\cdot\varphi_2\right)\cdot\sin\varphi_2; \\ Y_2 = -\left(\xi(\lambda_1)-R_{r2}\right)\cdot\sin\varphi_2 + \\ +\left(\eta(\lambda_1)-R_{r2}\cdot\varphi_2\right)\cdot\cos\varphi_2.; \end{cases}$	$\frac{\dot{X}_{2\lambda_1}}{\dot{X}_{2\varphi_2}} = \frac{\dot{Y}_{2\lambda_1}}{\dot{Y}_{2\varphi_2}}$	$0 \le \lambda_1 \le 1$
$\overset{\frown}{GH}$	$\begin{cases} X_2 = \left(\xi(\lambda_2)+R_{r_2}\right)\cdot\cos\varphi_2 - \\ -\left(\eta(\lambda_2)-R_{r2}\cdot\varphi_2\right)\cdot\sin\varphi_2; \\ Y_2 = -\left(\xi(\lambda_2)-R_{r2}\right)\cdot\sin\varphi_2 + \\ +\left(\eta(\lambda_2)-R_{r2}\cdot\varphi_2\right)\cdot\cos\varphi_2.; \end{cases}$	$\frac{\dot{X}_{2\lambda_2}}{\dot{X}_{2\varphi_2}} = \frac{\dot{Y}_{2\lambda_2}}{\dot{Y}_{2\varphi_2}}$	$0 \le \lambda_2 \le 1$

Two adjacent points, the distance *ds*:

$$ds = \sqrt{\left(X_{2i+1} - X_{2i}\right)^2 + \left(Y_{2i+1} - Y_{2i}\right)^2} \le \varepsilon, \quad (2)$$

if *ds* is sufficiently small, $\varepsilon = 1 \cdot 10^{-2} ... 1 \cdot 10^{-1}$, is obtained:

$$tg\beta_i = \frac{\left|Y_{2i+1} - Y_{2i}\right|}{\left|X_{2i+1} - X_{2i}\right|}, \quad (3)$$

elementary segment slope determined by points $M_i\left[X_{2_i}, Y_{2_i}\right]$ and $M_{i+1}\left[X_{2_{i+1}}, Y_{2_{i+1}}\right]$, see Figure 3.

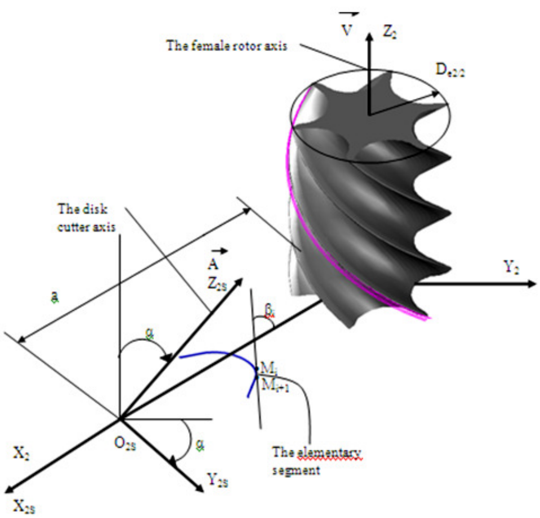

Fig. 3. *Elementary helical surface; coordinates systems*

Thus, elementary segment M_iM_{i+1} is described by equations as follows:

$$M_iM_{i+1}\left|\begin{aligned} X_2 &= X_{2i} + \lambda \cdot \cos\beta_i; \\ Y_2 &= Y_{2i} + \lambda \cdot \sin\beta_i, \end{aligned}\right. \quad (4)$$

$\lambda_{min} = 0$; $\lambda_{max} = ds$, see (4).

The segment M_iM_{i+1} tangent has the follow director parameters:

$$\vec{T}_{M_iM_{i+1}} = \cos\beta_i \cdot \vec{i} + \sin\beta_i \cdot \vec{j}. \quad (5)$$

After replacement we obtain:

Elementary helical surface is described in the helical motion (V, p_2) (left helix), as follows:

$$\begin{Vmatrix} X_2 \\ Y_2 \\ Z_2 \end{Vmatrix} = \omega_3^T(\theta_2)\begin{Vmatrix} X_{2i} \\ Y_{2i} \\ 0 \end{Vmatrix} + \begin{Vmatrix} 0 \\ 0 \\ -p_2\varphi_2 \end{Vmatrix} \quad (6)$$

or,

$$\begin{Vmatrix} X_2 \\ Y_2 \\ Z_2 \end{Vmatrix} = \begin{Vmatrix} \cos\theta_2 & -\sin\theta_2 & 0 \\ \sin\theta_2 & \cos\theta_2 & 0 \\ 0 & 0 & 1 \end{Vmatrix} \cdot \begin{Vmatrix} X_{2i} + \lambda\cos\beta_i \\ Y_{2i} + \lambda\sin\beta_i \\ 0 \end{Vmatrix} + \begin{Vmatrix} 0 \\ 0 \\ -p_2\theta_2 \end{Vmatrix}, \quad (7)$$

where θ_2 is a variable parameter, and p_2 – helical parameter.

For λ=0 (point M_i) - equations (6) is the helical line:

$$\begin{cases} X_2 = X_{2i}\cos\theta_2 - Y_{2i}\sin\theta_2; \\ Y_2 = X_{2i}\sin\theta_2 + Y_{2i}\cos\theta_2; \\ Z_2 = -p_2\theta_2. \end{cases} \quad (8)$$

Thus, the director parameters of the tangent to helical line (8), are calculated as follows,

$$\vec{T}_{M_i} = \frac{dX_2}{d\theta_2}\vec{i} + \frac{dY_2}{d\theta_2}\vec{j} - p_2\vec{k}. \quad (9)$$

The director parameters of the tangent to helical line, for the point M_i, are calculated from (9):

$$\begin{cases} \dfrac{dX_2}{d\theta_2} = -X_{2i}\sin\theta_2 - Y_{2i}\cos\theta_2; \\ \dfrac{dY_2}{d\theta_2} = -X_{2i}\cos\theta_2 - Y_{2i}\sin\theta_2; \\ \dfrac{dZ_2}{d\theta_2} = -p_2. \end{cases} \quad (10)$$

Normal to the elementary helical surface, can be approximated, taking into account (4)...(9), in the form:

$$\vec{N}_\Sigma = \vec{T}_{M_iM_{i+1}} \times \vec{T}_{M_i}. \quad (11)$$

$$\vec{N}_\Sigma = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ -X_{2i}\sin\theta_2 - Y_{2i}\cos\theta_2 & X_{2i}\cos\theta_2 - Y_{2i}\sin\theta_2 & -p_2 \\ \cos\beta_i & \sin\beta_i & 0 \end{vmatrix} \quad (12)$$

or, the vectorial form, (11),

$$\vec{N}_\Sigma = N_{X_2}\vec{i} + N_{Y_2}\vec{j} + N_{Z_2}\vec{k} \quad (13)$$

and the definitions:

$$\begin{cases} N_{X_2} = p_2\sin\beta_i; \\ N_{Y_2} = -p_2\cos\beta_i; \\ N_{Z_2} = \sin\beta_i\left[-X_{2i}\sin\theta_2 - Y_{2i}\cos\theta_2\right] - \cos\beta_i\left[X_{2i}\cos\theta_2 - Y_{2i}\sin\theta_2\right]. \end{cases} \quad (14)$$

Knowing the expression of the director parameters of elementary helical surface (14), we can write the meshing condition, Nikolaev [2].

We define:

-the disk cutter axis $\vec{A}$,

$$\vec{A} = \sin\alpha \cdot \vec{j} + \cos\alpha \cdot \vec{k}; \qquad (15)$$

- vector O_{2S},

$$OO_1 = a \cdot \vec{i}. \qquad (16)$$

The amount of a and α will be constructively defined, that the axis $\vec{A}$ is perpendicular to the outside helix female rotor, (De_2), Figure 3:

$$\tan\alpha = \frac{2\pi p_2}{\pi D_{e_2}} = \frac{2p_2}{D_{e_2}}; \qquad (17)$$

- p_2 is the helical parameter;
- a is the sum of the size of inner diameter of the rotor to be generated and outer diameter of the generating disk cutter.

The condition for determining the feature of the elementary helical surface is:

$$\left(\vec{N}_\Sigma, \vec{A}, \vec{r}_2\right) = 0, \qquad (18)$$

where r_2 is the vector from the current point (elementary helical surface) compared to O_{2S};

$$\vec{r}_2 = \vec{r} - a\vec{i};$$

$$\vec{r}_2 = \left[X_{2i}\cos\theta_2 - Y_{2i}\sin\theta_2\right]\vec{i} - a\cdot\vec{i} + \qquad (19)$$
$$+\left[X_{2i}\sin\theta_2 + Y_{2i}\cos\theta_2\right]\vec{j} - p_2\cdot\theta_2\cdot\vec{k}.$$

The meshing condition (18) becomes:

$$\left(\vec{N},\vec{A},\vec{r}\right) = \begin{vmatrix} \left(X_{2i}\cdot\cos\theta_2 - Y_{2i}\cdot\sin\theta_2 - a\right) & \left(X_{2i}\cdot\sin\theta_2 + Y_{2i}\cdot\cos\theta_2\right) & -p_2\cdot\theta_2 \\ -p_2\cdot\sin\beta_i & p_2\cdot\cos\beta_i & \left(X_{2i}\cdot\cos\left(\theta_2-\beta_i\right) + Y_{2i}\cdot\sin\left(\theta_2-\beta_i\right)\right) \\ 0 & \sin\alpha & \cos\alpha \end{vmatrix} \le \varepsilon, \qquad (20)$$

$\varepsilon = (1\text{x}10^{-3})$.

The points that satisfy the basic meshing condition (20) and belonging to the helical surface represent the characteristic curve - the curve of contact between the helical surface and the primary peripheral surface of the disk cutter.

Be

$$X_2^C = \left\{X_{2i}^C \quad Y_{2i}^C \quad Z_{2i}^C\right\}^T, \text{ i=1...m} \qquad (21)$$

the matrix of points on the characteristic curve.

The transformation of coordinates:

$$\begin{cases} X_{2S} = X_{2i}^C - a; \\ Y_{2S} = Y_{2i}^C\cos\alpha - Z_{2i}^C\sin\alpha; \\ Z_{2S} = Y_{2i}^C\sin\alpha + Z_{2i}^C\cos\alpha, \end{cases} \qquad (22)$$

$i = 1...m.$

move the coordinates of characteristic curve in the reference system belonging to the disk cutter, $X_{2S}Y_{2S}Z_{2S}$.

The axial section of the disk cutter is obtained from (22), in the form:

$$\begin{cases} H = Z_{2S} \\ R = \sqrt{X_{2S}^2 + Y_{2S}^2} \end{cases} \qquad (23)$$

$i = 1...m.$

The algorithm solves all areas of elementary helical surfaces, corresponding to all segments $\widehat{AB}$, $\overline{BC}$, $\widehat{CD}$, $\widehat{EF}$, $\overline{FG}$, $\widehat{GH}$, $\widehat{HA}$, components of the rotor.

NOTE

If the distance between successive points along the generator is considered small enough (see (2)) these can be approximated the basic equations for helical surface case, λ=0. Thus, elementary helical surface is reduced to a helix and the surface generated is seen as a family of helical lines. This approximation significantly reduces the computation effort and processing time, to determine the characteristic curve and the axial section of the tool disk.

The method is applicable to all segments of the arc of a helical surface.

4. Numerical applications

We present two frontal applications, different constructive solutions.

· **First application (screw compressor, ratio 4/6)**

Table 2. *The constructive date of the reference rack, (see Figure 2)*

R_0 [mm]	r_0 [mm]	u_{max}[mm]	$\psi_{max}[^0]$	$\upsilon_{max}[^0]$	$\upsilon_{1max}[^0]$	u_{1max}[mm]	L_p[mm]	c_0[mm]	Rr_2[mm]
22.000	1.100	10.300	63.400	63.400	58.285	6.451	50.265	4.000	48.000

Table 3. *The axial profile of disk cutter coordinates of female rotor*

Crt. no.	R[mm]	H[mm]	Crt. no.	R[mm]	H [mm]	Crt. no.	R[mm]	H [mm]	Crt. no.	R[mm]	H [mm]
1	47.786	-12.790	11	52.575	-10.917	21	57.217	9.849	31	52.136	11.664
2	48.087	-12.370	12	53.092	-10.763	22	56.705	10.022	32	51.631	11.856
3	48.462	-12.227	13	53.610	-10.612	23	56.195	10.196	33	51.128	12.050
4	48.974	-12.055	14	54.129	-10.463	24	55.685	10.373	34	50.625	12.247
5	49.486	-11.886	15	54.648	-10.316	25	55.176	10.551	35	50.123	12.445
6	49.999	-11.719	16	55.168	-10.172	26	54.667	10.732	36	49.623	12.645
7	50.513	-11.554	17	55.688	-10.030	27	54.160	10.914	37	49.123	12.848
8	51.028	-11.392	18	56.210	-9.890	28	53.652	11.099	38	48.625	13.054
9	51.543	-11.231	19	56.731	-9.751	29	53.146	11.285	39	48.136	13.281
10	52.059	-11.073	20	57.253	-9.612	30	52.640	11.473	40	47.813	13.684

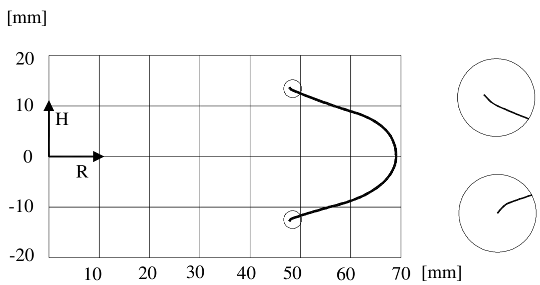

Fig. 4. *Female rotor – the tooth profile of disk cutter*

In the Table 3 are described the axial section coordinates of disk cutter for the female rotor.

The flank of female rotor helicoidal surface is a helicoidal cylindrical surface, constant step, left helix, helicoidal parameter p_2 and $a = R_s + R_{2int}$.

Table 4. *The geometrical constructive elements of the female rotor*

Rr_2 [mm]	48.000
$Rint_2$ [mm]	26.034
a [mm]	95.032
p_2 [mm]	28.649
R_S [mm]	68.998
β [°]	59.181

Helical parameters are calculated with equation:

$$p_2 = \left(\frac{360^\circ}{300^\circ \cdot i} \cdot D_1 \right) \cdot \frac{1}{2 \cdot \pi} \qquad (24)$$

with i=4/6 or 3/5.

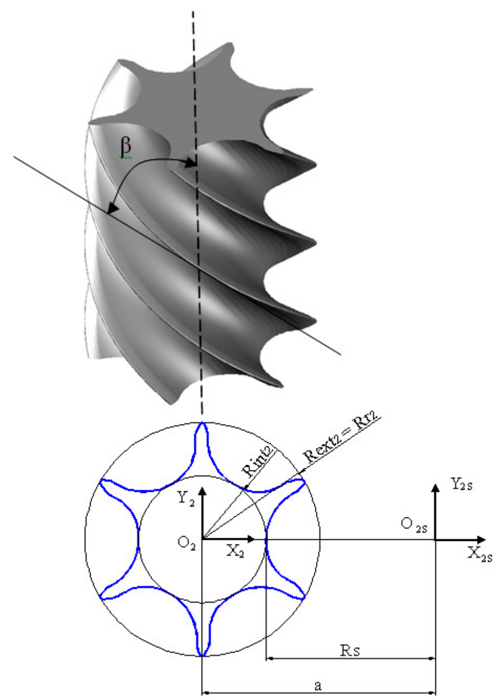

Fig. 5. *The geometrical constructive elements of female rotor*

Second application (screw compressor, ratio 3/5)

Table 5. *The constructive data of the reference rack (see Figure 2)*

R_0 [mm]	r_0 [mm]	u_{max}[mm]	$\psi_{max}[^0]$	$\upsilon_{max}[^0]$	$\upsilon_{1max}[^0]$	u_{1max}[mm]	L_p[mm]	c_0[mm]	Rr_2[mm]
22.000	2.000	7.045	70.300	70.300	35.054	7.774	62.832	4.000	50.000

Table 6. *The axial profile of disk cutter coordinates of female rotor*

Crt. no.	R [mm]	H [mm]	Crt. no.	R [mm]	H [mm]	Crt. no.	R[mm]	H [mm]	Crt. no.	R [mm]	H [mm]
1	45.609	-9.426	11	60.330	-6.429	21	65.681	4.944	31	50.284	11.476
2	45.941	-9.027	12	60.847	-6.263	22	65.265	5.292	32	49.810	11.740
3	46.450	-8.844	13	61.360	-6.088	23	64.831	5.617	33	49.336	12.005
4	46.983	-8.743	14	61.869	-5.899	24	64.381	5.920	34	48.863	12.271
5	47.517	-8.647	15	62.373	-5.699	25	63.917	6.201	35	48.391	12.537
6	48.051	-8.554	16	62.872	-5.485	26	63.444	6.466	36	47.919	12.805
7	48.586	-8.465	17	63.364	-5.257	27	62.960	6.712	37	47.445	13.073
8	49.122	-8.379	18	63.849	-5.013	28	62.469	6.941	38	46.977	13.342
9	49.658	-8.295	19	64.325	-4.753	29	61.970	7.155	39	46.506	13.612
10	50.195	-8.215	20	64.790	-4.475	30	61.466	7.356	40	46.036	13.883

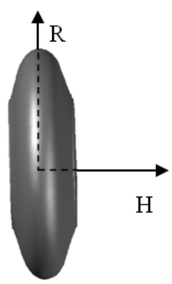

Fig. 6. *The solid of disk cutter for female rotor*

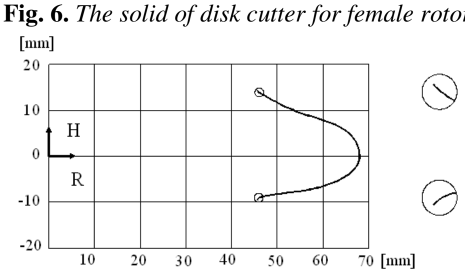

Fig. 7. *Female rotor – the tooth profile of disk cutter*

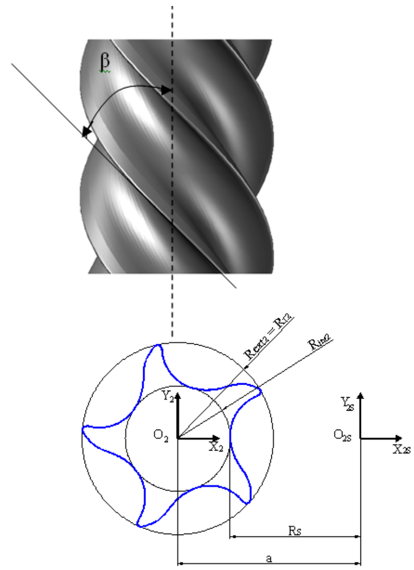

Fig. 8. *The geometrical constructive elements of female rotor*

In Table 6 are described the axial section coordinates of disk cutter for the female rotor.

The flank of female rotor helicoidal surface, is a helicoidal cylindrical surface, constant step, left helix, helicoidal parameter p_2 and $a = R_s + R_{2int}$.

Table 7. *The geometrical constructive elements of female rotor*

Rr_2 [mm]	50.000
$Rint_2$ [mm]	27.442
a [mm]	95.436
p_2 [mm]	33.742
R_S [mm]	67.994
β [°]	67.978

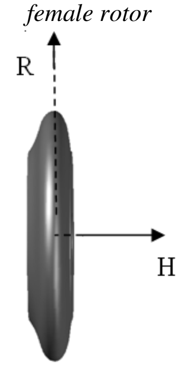

Fig. 9. *The solid of disk cutter for female rotor*

6. Conclusions

It was considered a constructive form of a helical screw compressor female rotor.

Ratios studied were 4/6 and 3/5.

To determine profiles generating disk cutter the method of tangents was applied.

Solid models and the disk cutter were presented.

Acknowledgement

The authors gratefully acknowledge the financial support of the Romanian Ministry of Education, Research and Innovation through grant PN_II_ID_791/2008.

REFERENCES

[1]. Litvin, F. L., 1989, “*Theory of Gearing*”, NASA RP-1212 (AVSCOM 88-C-035), Washington, D.C.

[2] Oancea, N., *Surface generation through winding, Volume I, Fundamental Theorems*, 2004, “Dunărea de Jos”University publishing house, ISBN 973-627-106-4; ISBN 973-627-107-2.

[3] Oancea, N., *Surface generation through winding, Volume II, Complementary Theorems*, 2004, “Dunărea de Jos”University publishing house, ISBN 973-627-106-4, ISBN 973-627-170-6.

[4] Teodor, V. “*Contribution to the elaboration of a method for profiling tools-tools which generate by enwrapping*”, Lambert Academic Publishing, ISBN 978-3-9433-8261-8.

[5] Zhou Z., 1992, "*Computer Aided Design of a Twin Rotor Screw Refrigerant Compressor*" Proceedings of the 1992 International Compressor Engineering Conference at Purdue, West Lafayette, pp. 457–465.

[6] Litvin, F. L., and Feng, Pin-Hao, 1997, "*Computerized Design, Generation, and Simulation of Meshing of Rotors of Screw Compressor*”.

[7] Stosic N, Smith I. K, and Kovacevic A, *2002: Optimization of Screw Compressor Design*, XVI International Compressor Engineering Conference at Purdue, July 2002.

[8] Stosic, N., Mujic, E., Smith, I.K., Kovacevic, A., “*Profiling of Screw Compressor Rtotors by Use Direct Digital Simulation*”. International Compressor Engineering Conference at Purdue, July 2008.

[9] Tseng Ching-Huan, “*Synthesis and Optimization for Rotor Profiles in Twin RotorScrew Compressors*”, Journal of Mechanical Design december 2000, Vol. 122 Õ 545.

[10] Stosic, N., Smith, I., Kovacevic, A., “*Screw Compressors – Mathematical Modelling and Performance Calculation*”. Springer, feb. 2005.

[11] Baicu, I., Oancea, N., “*Profilarea sculelor prin modelare solida*” Editura TEHNICA-INFO,Chişinău, 2002, ISBN 9975-63-172-X.

Metodă pentru profilarea sculei disc destinate prelucrării rotorului condus din componența compresorului elicoidal

—Rezumat—

Rotoarele compresoarelor elicoidale sunt mărginite de suprafețe cilindrice elicoidale de pas constant. Generarea acestor tipuri de suprafețe este posibil a fi realizată utilizând freze disc a căror suprafețe periferice sunt suprafețe de revoluție.

În prezenta lucrare este propusă o metodă şi un algoritm pentru profilarea suprafețelor periferice primare ale frezelor disc, reciproc înfăşurătoare cu suprafețele elicoidale ale rotoarelor compresorului elicoidal.

Algoritmul propune substituirea ecuațiilor analitice ale profilului compus al secțiunii transversale a rotorului cu polinoame Bezier de grad inferior.