THE STATIC TESTING OF THE ELASTIC AND SAFETY CLUTCHES

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Abstract: The paper presents the roll and importance of testing for the elastic and safety clothes. There are also presented the function, characteristics theoretical and working principle of an elastic safety clutch. This clutch represents a new type clutch, that by its simple functions, accomplishes the functions of a combined clothe. Starting from the functions and characteristics of the elastic and safety clutch, it is proposed a testing installation. There are also presented the characteristics static experimental, respectively conclusion references of a study this clutch.

1. INTRODUCTION

In the case of diverse applications, there can be combined the simple functions, obtaining a combined coupling. In this case, the combined coupling is obtained by the connection, of two or more simple clutches, in a certain manner, on purpose to accomplish accordingly the imposed complex functional role of mechanical transmission [1], [2].

The clutches testing follows essentially capable performances establishing of the tested solution, confirming or not the viability of the constructive and technological solutions that are chosen.

Thus there are spotlighted the shortcomings in design and in execution, suggesting the further research direction

2. THE STRUCTURAL SCHEME OF ELASTIC AND SAFETY CLUTCH

Elastic and safety clutches are characterized by the following representative functions [2] [3]:

- it makes the connexion between two shafts (with fix or variable relative position) and it ensures the transmission of the moment and of the rotation velocity between shafts;
- the strength transmission is interrupted when the resistant moment autumns an imposed limit value ; the interruption of the energetic wave it's being realize basis on an elastic element deformation (when the deformation achieves the value which correspond to the limit moment, the connexion between the semi clutches will be interrupted).

From the analysis of the proprieties suitable to the elastic and safety clutch, a big importance goes to the elastic element modulation. That it will ensure the automatic interruption of the energetic wave, when is reached the limit value of the moment.

Under constructive aspect, elastic and safety clutches could be generated in diverse main variants. Figure 1 presents the structural scheme of three – elastic and safety clutches – variants [2], [3]. This variant is generated from a plane mechanism with rotation cam and degenerate followers in elastic follower.

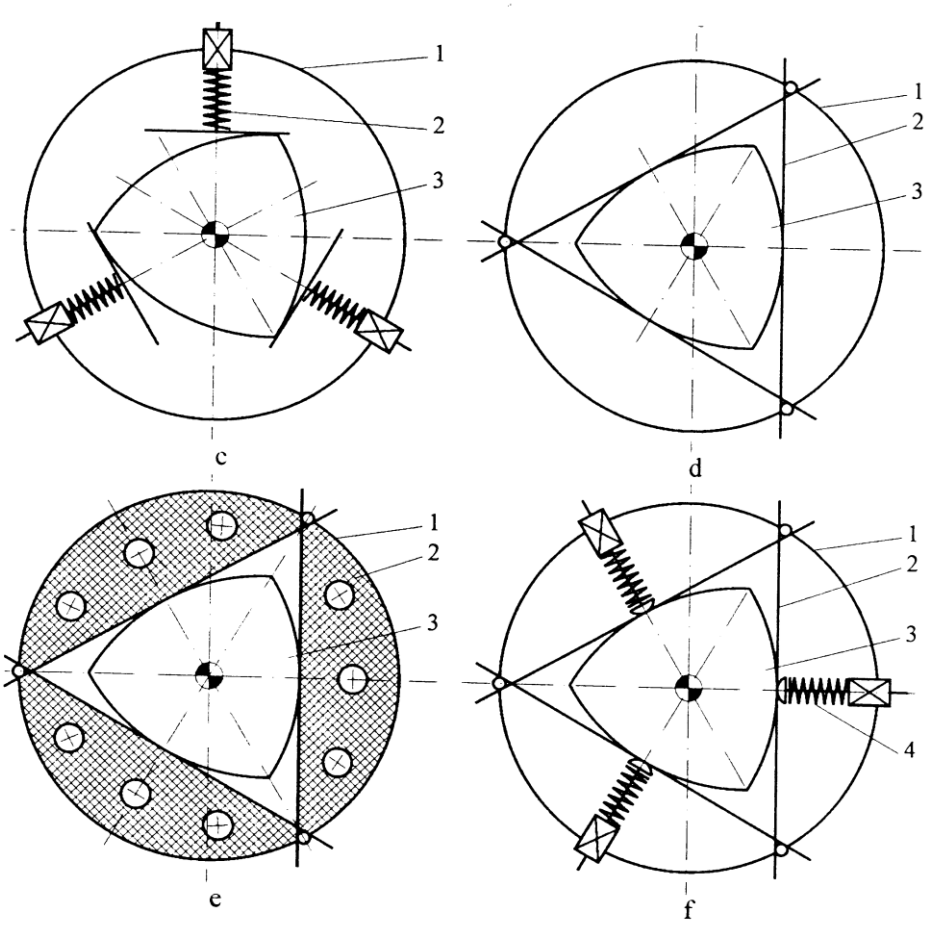

Fig.1 The structural scheme of three – elastic and safety clutches – variants

The clutch has in his componance the equiangular cam 3, which represents a semi clutch; the second semi clutch it's constituted from flange1 and degenerated followers in elastic elements 2 (lamellar bow, helicoidally bow, and rubber shoes).

The charge is being transmitted from one semi clutch to the other through the degenerated followers. The pushing force of the degenerated followers is given by the compression helicoidally bows, by lamellar bows and rubber elements. When the limit torsion moment which can be transmitted by the clutch is overfull field, between the semi clutches appears a relative rotation movement, which allows the charge interruption of the mechanical transmission.

The static testing of the elastic and safety clutches must allow the determination of the maximum limits that can be touched by the functional parameters for the elastic clutches – torque moment, rotation positional modifications, damping capacity of the jars and of the torque vibrations – as well as for the safety clutches – the limit torque moment that can be transmitted by the clutch.

3. STATIC EXPERIMENTAL CHARACTERISTICS

The elastic and safety clutches are characterized through a variable rigidity (nonlinear characteristic) – relation (1) – and the protection condition of the mechanical transmission is expressed with relation (2).

$$k(\varphi) = \frac{dMt(\varphi)}{d\varphi} \quad (1)$$

$$M_{t\,lim}(1+\Delta) \le M_{t\,max\,a} \quad (2)$$

Where:

k – the clutch rigidity;

φ – the relative rotation angle of the semi clutches;

M(φ) – the torsion moment which corresponds to the clutch deformation with angle φ;

$M_{t\,lim}$ – the moment when is produced or is ended the decoupling;

$M_{tmax\,a}$ – the maximum torque moment that is admitted by the resistance of the weakest element of the clutch;

Δ – the relative error of the safety clutch;

The static experimental characteristics, of the three variants of elastic and safety (figure 1), are presented in figure 2 [3].

The elastic characteristics that were presented had been determined for the elastic and safety clutch.

◊ (rhomb) – With degenerated followers in lamellar bows (figure 1d);

□ (square) – With degenerated followers in rubber shoes (figure 1e);

Δ (triangle) – With degenerated followers in lamellar bows and elicoidal bows (for compression) (fig. 1f);

In figure 3 there are presented the static experimental characteristic for the elastic and safety clutches with degenerated followers in multilamellar bows [2].

- In figure 3a – radial deviations of 1, 2, 4 mm, given to the reference position – the characteristic is progressive and close to the reference rigidity; when the moment transmitted rises, the deviation rises also;
- In figure 3b – angular deviation of 2°, 4° given to the reference position – the torque moment and the elasticity are rising when the angular deviation is rising;

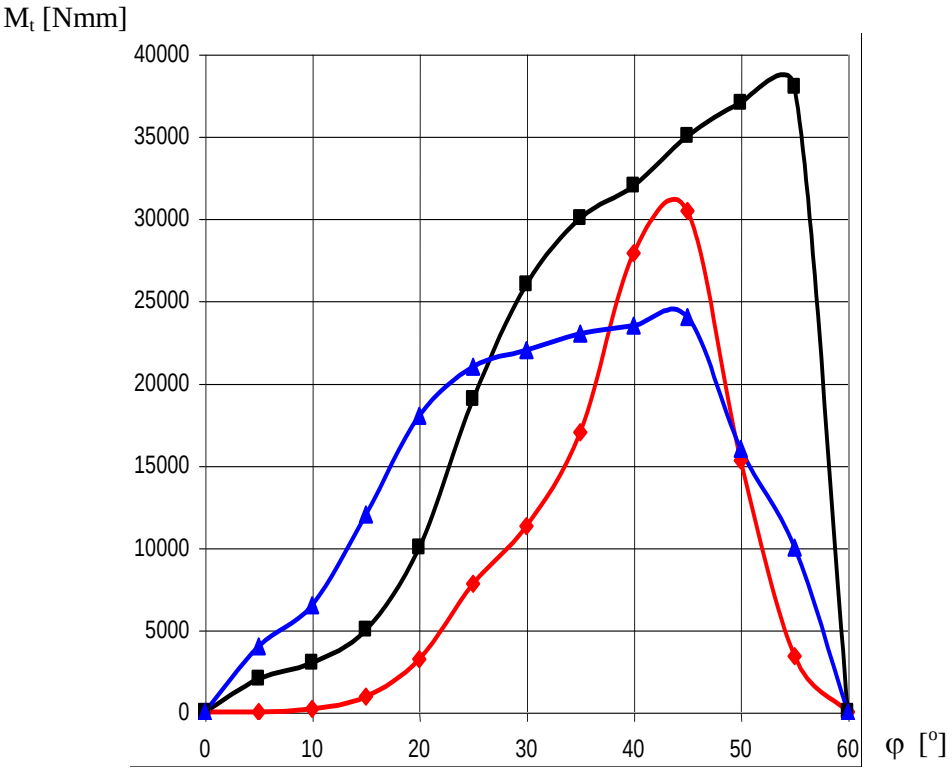

Fig.2 The static experimental characteristics

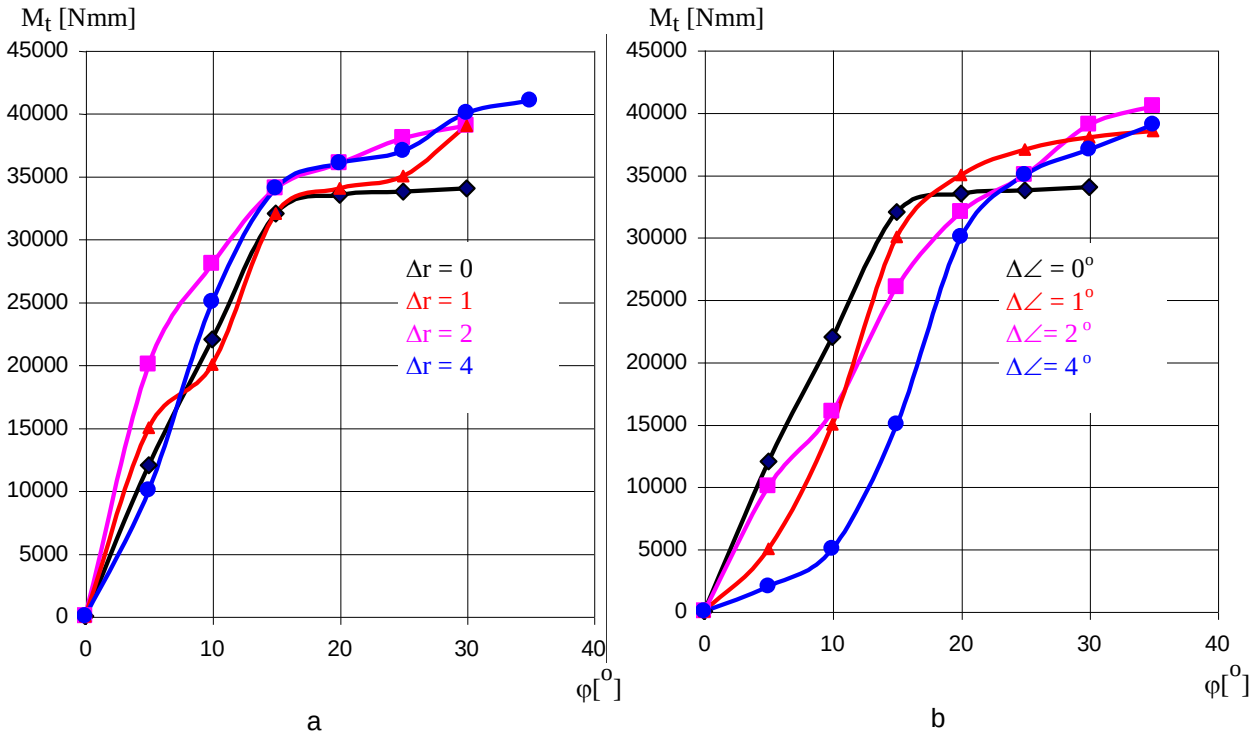

Fig.3 The static experimental characteristics radial and angular deviations

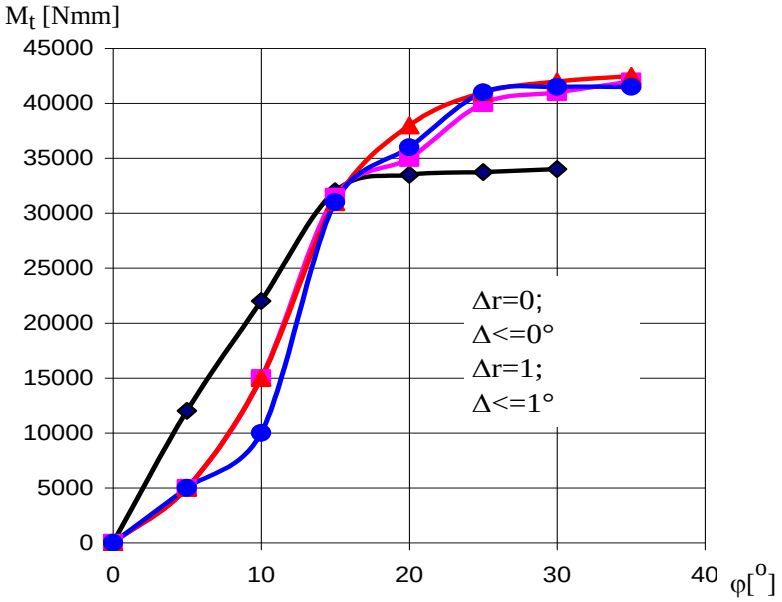

Fig.3,c The static experimental characteristics combined deviation

- In figure 3c – combined deviation (radials and angular); the characteristics are close as rigidity and the torque moment rises when the deviation rises;

In figure 4 there are presented the static experimental characteristics for the elastic and safety clutch with degenerated followers in rubber shoes.

- Fig 4a – radial deviations of 1, 2, 4 mm;
- Fig 4b – angular deviations of 1°, 2°, 4°;
- Fig 4c – radial and angular combined deviations;

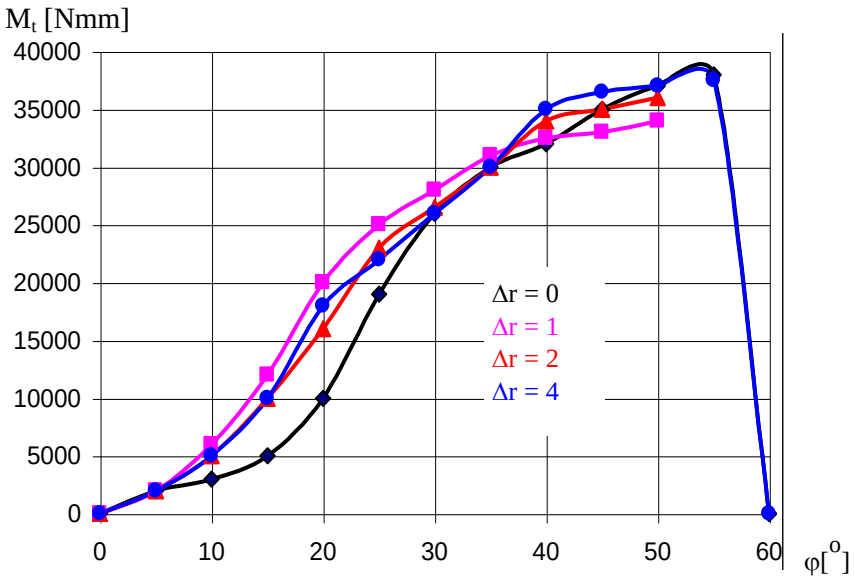

Fig.4a

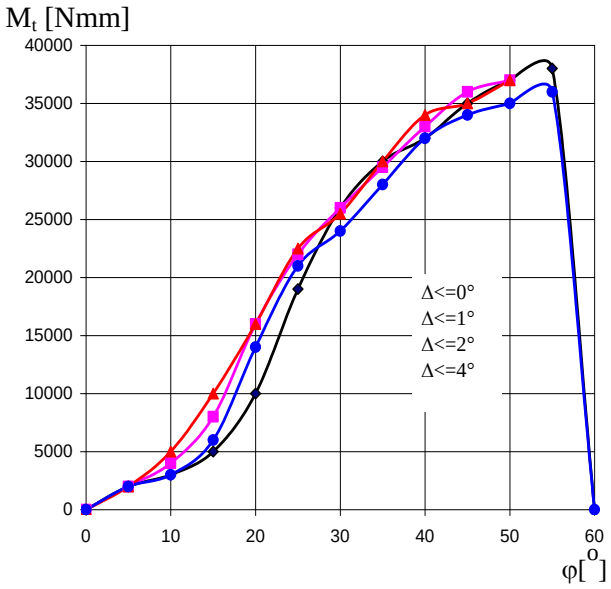

Fig.4,b

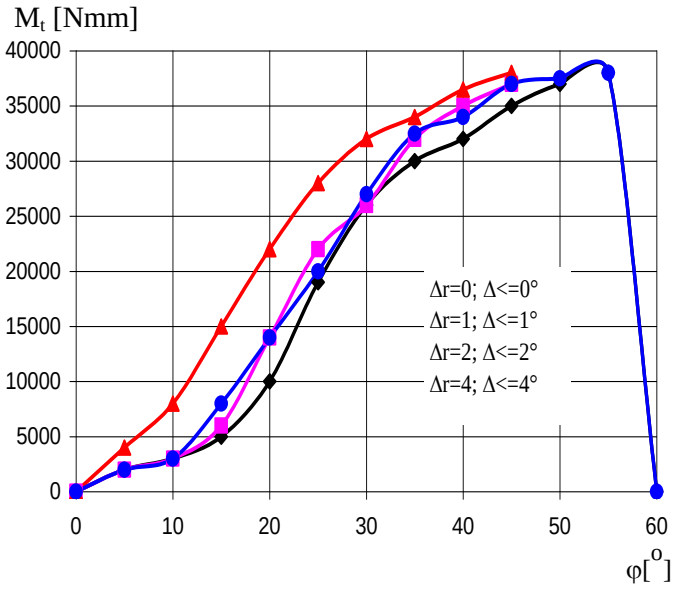

Fig.4,c

Fig.4 The static experimental characteristics for the elastic and safety clutch with degenerated followers in rubber shoes

Analyzing this graphics, the next conclusions can be formulated: the characteristics are progressive; the rigidities are closely, as well as the maximum torque moment that can be transmitted.

In figure 5 there are presented the static experimental characteristics for the elastic and safety clutch with degenerated followers in lamellar bows and in elicoidal bows for compression.

- Fig 5a – radial deviations of 0, 2, 4 mm;
- Fig 5b – angular deviations of 0°, 2°, 4°;
- Fig 5c – radial and angular combined deviations;

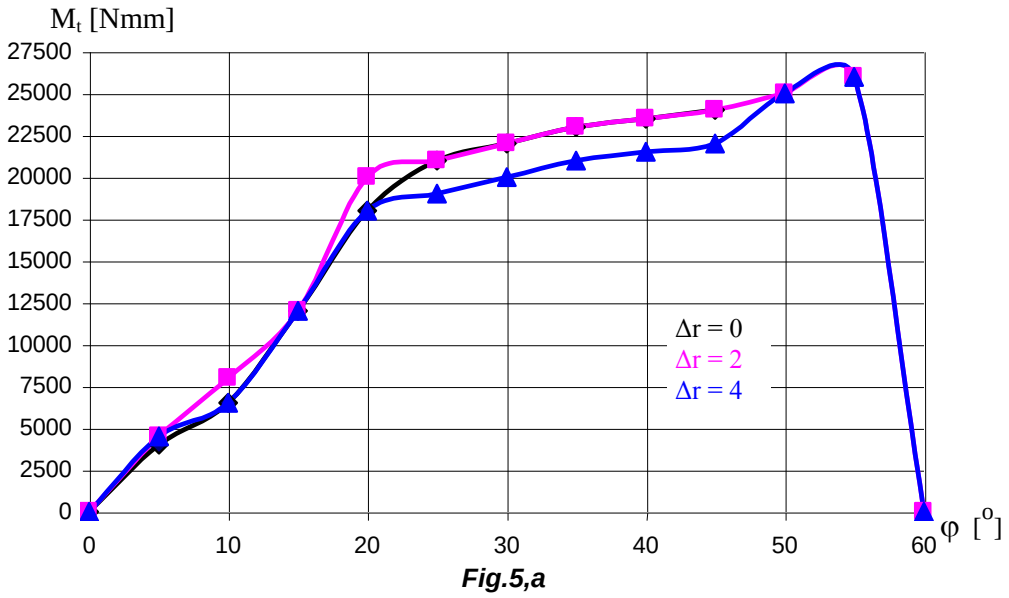

Fig.5,a

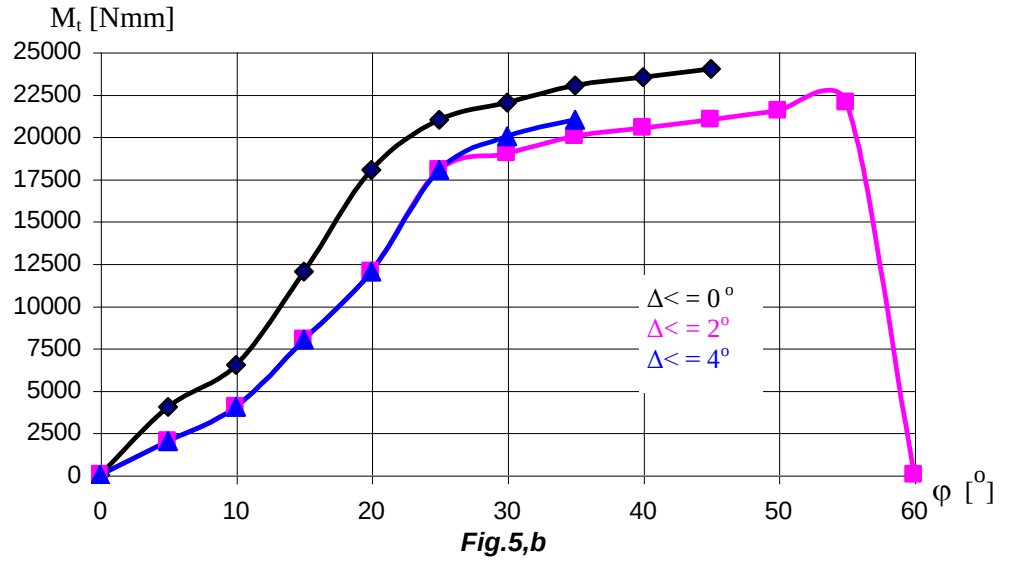

Fig.5,b

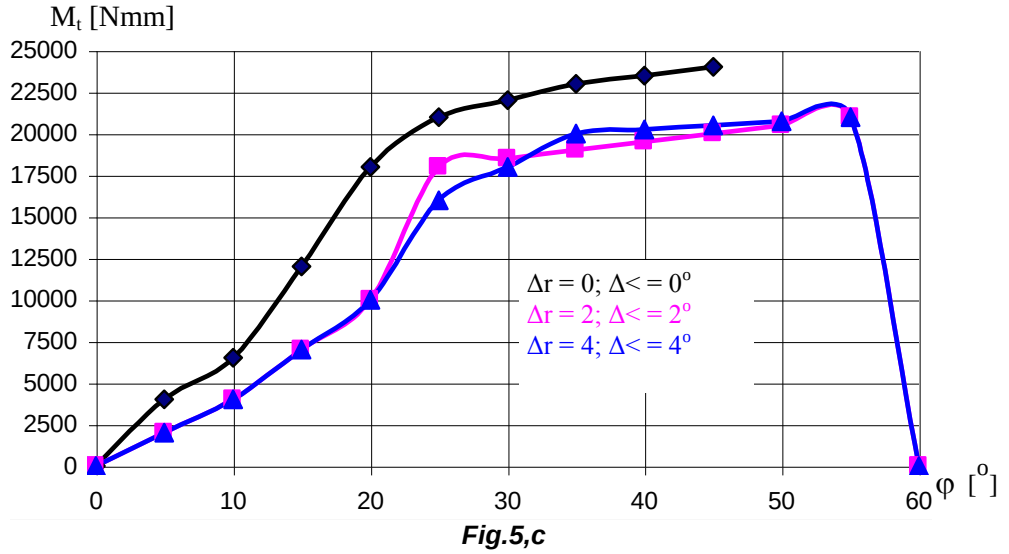

Fig.5,c

Fig.5 The static experimental characteristics for the elastic and safety clutch with degenerated followers in lamellar bows and in elicoidal bows

4. CONCLUSIONS

The graphics study leads to the next conclusions: the elasticity rises for the radial and combined deviations, and for the angular deviations the rigidities are almost equal.

From the comparative analysis of the presented graphics it results that the radial, angular and combined deviations don't modify significantly the reference characteristic of the tested clutch.

The elastic and safety clutch can take over axial deviations in function of the constructive dimensions

5. References

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