Research Paper Engineering

Influence of The Position Deviations on The Characteristic of Elastic and Safety Clucth

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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.

KEYWORDS mechanical transmission, clutches, elastic, safety, simple.

INTRODUCTION

A condition imposed to the elastic clutches is that at the breakage of an element, the clutch does not failure immediately. If there is only an elastic element, the total breakage of the clutch has to be inferred, in case of partial fractures or the fissures. Another condition imposed to elastic clutches is that the elastic elements that can rapidly be destroyed, to be easily replaced – if it is possible without the clutch disassembling or the axial displacement of the axle stubs [5], [9], [11].

The elastic clutch could take over, overloads up to a certain torque value. Over this value, when the transmission is not provided with a load disengagement system, the elastic elements of the clutch are destroyed, this corresponding with the placing of transmission out of the operation.

The safety clutch fulfils (besides the main function of the torque transmission) the function of torque limitation or automatic interruption of the connection between the coupled shafts, in the case of some overloads' occurrence, during the performance.

The safety clutches assure the transmission performance up to the limit torque value, for what the safety elements are designed. Over this value, it appears the relative slipping between the semi-clutches, which involves the mechanical transmission protection. Taking the data above into consideration, it results the necessity of some clutches, that by the associated functions to allow the load disengagement before that the elastic elements to be destroyed [5].

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 [4], [6], [9].

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

ELASTC AND SAFETT CLUTCH

Elastic and safety clutches are characterized by the following representative functions [5], [8], [11]:

it makes the connection 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 connection between the semi clutches will be interrupted).

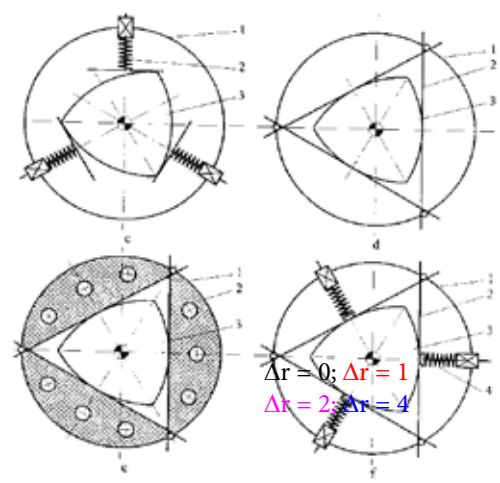


Figure 1: The structural design of elastic and safety clutch

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 [8], [9]. This variant is generated from a plane mechanism with rotation cam and degenerate followers in elastic follower.

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, elicoidal 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 elicoidal bows, by lamellar bows and rubber elements. When the limit torsion moment which can be transmitted by the clutch is overfulfield, 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 [1], [6], [9].

STATIC 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) [8], [10], [11].

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

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

Where:

k – the clutch rigidity;

ϕ – the relative rotation angle of the semi clutches; $M_t(\phi)$ – 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;

$M_{t\,max\,a}$ – 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 [9].

The static experimental characteristics, of the three variants of elastic and safety (figure 1), are presented in figure 2 [9]. The elastic characteristics that were presented had been determined for the elastic and safety clutch [6], [7].

◊ (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 (figure. 1f);

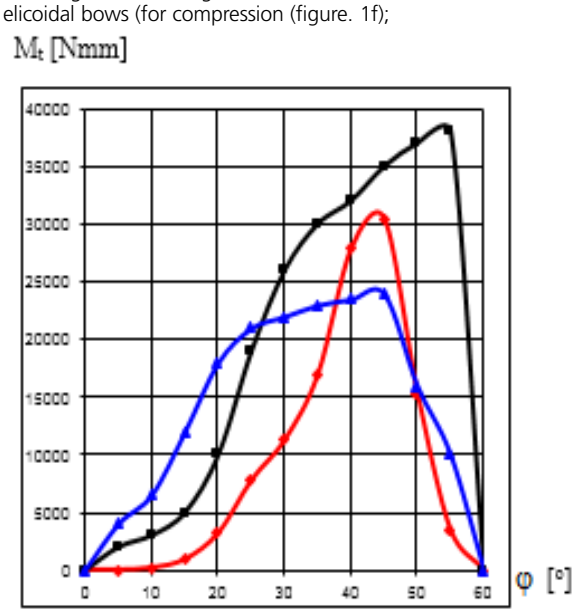


Figure 2: Static experimental characteristics

In figure 3 there are presented the static experimental characteristic for the elastic and safety clutches with degenerated followers in multilamellar bows [5].

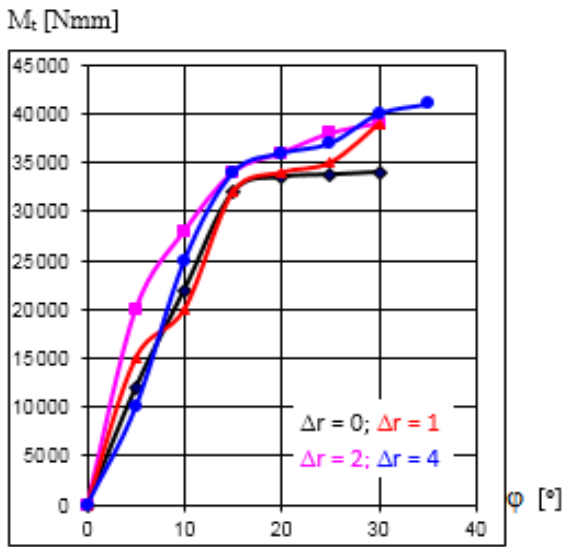


Figure 3. a: Radial deviations

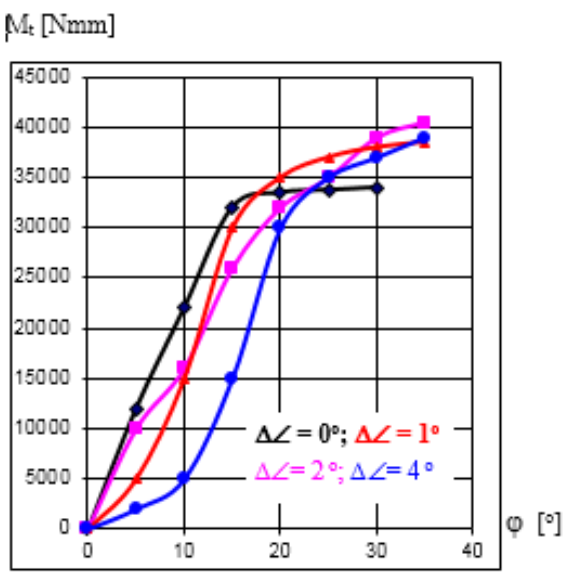


Figure 3. b: Angular deviation

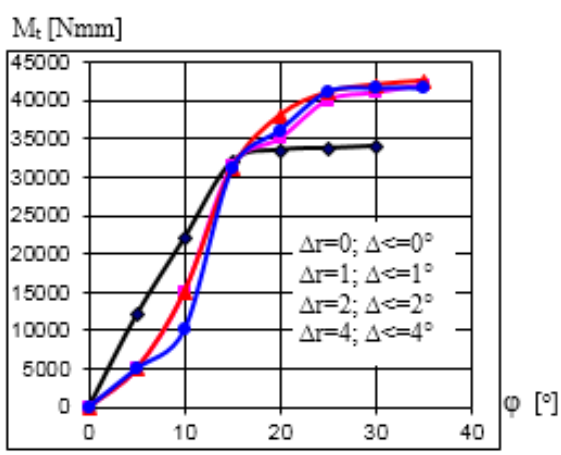


Figure 3. c: Combined deviation

In figure 3 there are presented the static experimental characteristic for the elastic and safety clutches with degenerat-

ed 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;
- 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;

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.

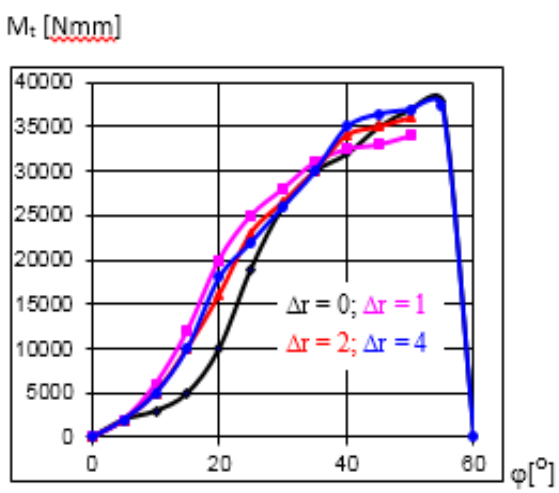


Figure 4. a: Radial deviations

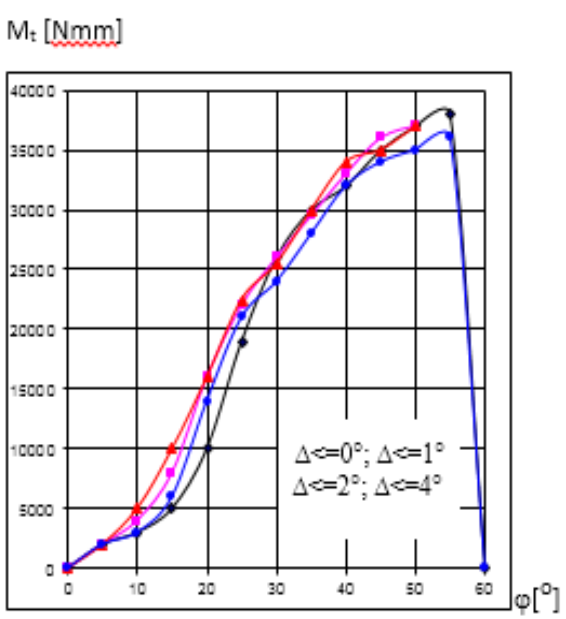


Figure 4. b: Angular deviations

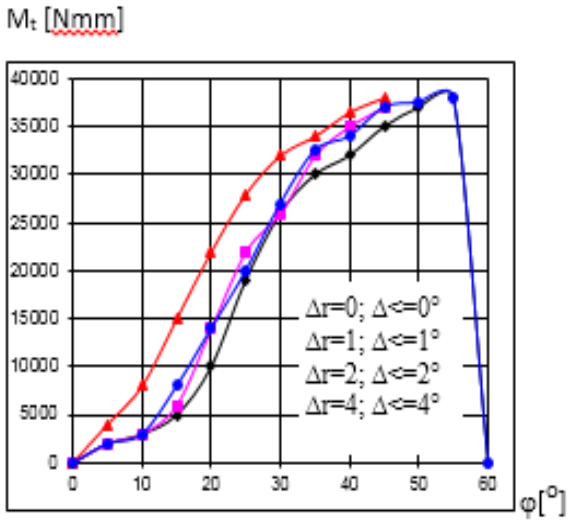


Figure 4. c: Combined deviations

In figure 5 there are presented the static experimental characteristics for the elastic and safety

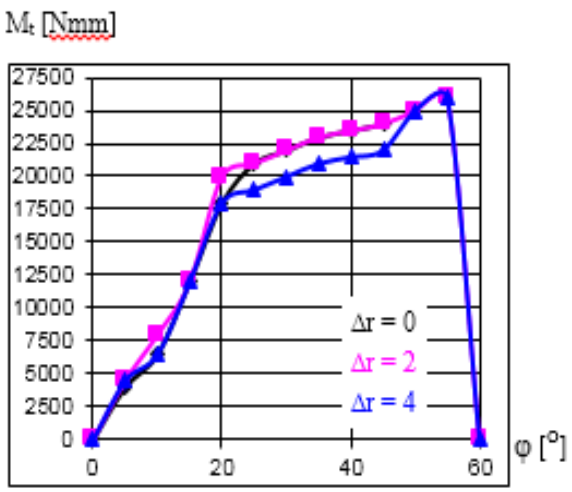


Figure 5. a: Radial deviations

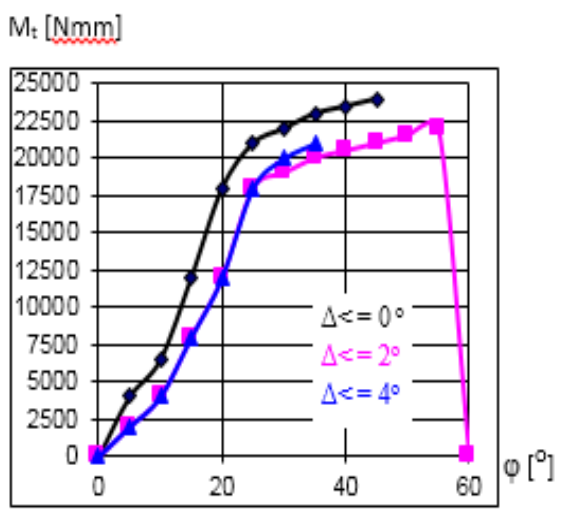


Figure 5. b: Angular deviations

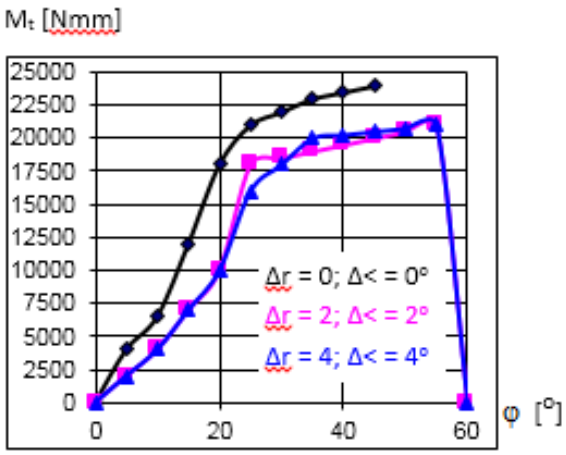


Figure 5. c: Combined deviations clutch with degenerated followers in lamellar bows and in elicoidal bows for compression.

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

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 of the cam respectively of the multilamelar bows.

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