

## INFLUENCE PRESTRESSING OF TEXTILE ON STIFFNESS UPHOLSTERY OF AUTOMOBILE SEAT

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**Abstract:** Comfort of the seat is influenced with a complex of properties and factors, such as softness, hardness, permeability and others. These and other properties are important for the of the seat upholstery. The quality of the seat upholstery can be possible evaluated from two aspects, firstly according to the properties of the foam filler and secondly properties of the covering material. The foam has to provide softness sitting of drivers; however it's most important task is to absorb bodily vibrations, which are created while driving the car on uneven ground and successive transmission of vibration to the seat. We make the experiments and the computer model and we study optimum conditions, when foam of upholstered car seat absorb biggest values of vibrations. Before the experiment were built - up the simulation model. The dissipation energy was investigated in the bolster, which was loaded by simplification model of driver for harmonics actuating of the pad of upholstered seat. The stiffness seat isn't necessary regulate only by the property of the foam, the stiffness can be regulate prestressed of the textile with foam, how it was showed by experiments. The next development will orient on search of textile material acceptable for this type regulation, eventually we will project new acceptable textile material. The aim of research is the developing of simple way of the regulation of stiffness upholstered seat, so that all passengers could choose stiffness seat squab, which matches their bodily proportion.

### 1. Introduction

Car is used in these years more often than earlier like means working; he accrues number of drivers, who have ailment dorsodynia. Perhaps therefore automakers employ oneself in research works about comfort of seating presently. The quality seating influences comfort of riding in car. Wrong ergonomics of seat may give rise to mistaken position of driver at sitting, it's why increasing of number drivers with illness of dorsodynia.

Comfort of seat is influenced with complex of properties and factors, such as softness, hardness, permeability and other. These and next properties are important for upholstery of seat. Quality upholstery of seat is possible evaluate from two aspects, firstly by properties of foam filler and secondly by properties of covering material, see fig. 1. Foam supports softness sitting of driver; however is great important by absorbing of whole bodily vibration too, which are created with ride of car on disturbed surface of roadway and successive transmission of vibration to the seat.



*Figure 1: Seat of car*

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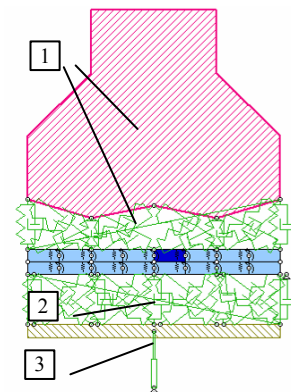
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## 2. Simulation

For these simulations it is possible multi-body models to use, see Fig. 2. Where symbol 1 means model of driver, symbol 2 is model of viscoelastic material of upholstered seat and symbol 3 is the pad which is harmonic excitation. Prestress of fabric was changed by initial length of the spring, which together with cataract simulates viscosity characteristics of fabrics.

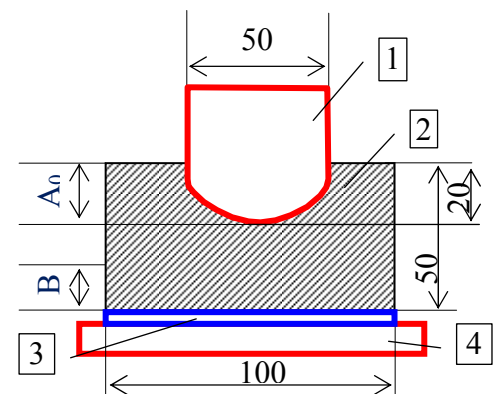
The stiffness seat isn't necessary regulate only by property of foam, the stiffness can be regulate prestressed of textile with foam, how it was showed by experimentation. The next development will orient on search of textile material acceptable for this type regulation, eventually we will project new acceptable textile material. The aim of research is the developing of simple way of the regulation of stiffness upholstered seat, so that all passengers could choose stiffness seat squab, which matches their bodily proportion [1], [2].



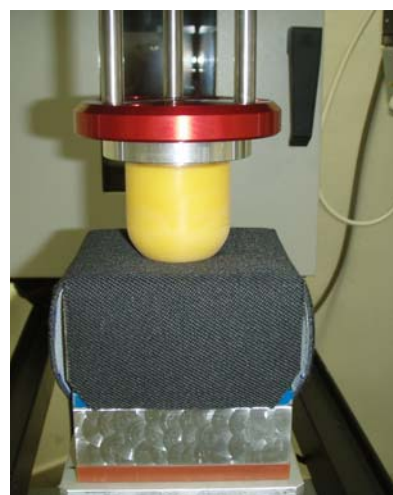
**Figure 2: Simulation**

## 3. Experiment

In our university it is being developed new method of regulation of softness or hardness of car seat, it means change its stiffness. We search by experiments and by computer model optimum conditions, when foam of upholstered car seat absorb biggest values of vibrations. For experiments were used next materials; polyurethane foam about proportions 100x100x50 mm, two sorts upper jaw (first profile - rounded cylinder, second profile - circular), and two sorts of textile, Fig. 3. The sample (2) was compressed cyclical (1) by harmonic signal, its function was:  $x(t) = A_0 + A_1 \sin(2\pi ft)$ , where:  $A_0 = 20$  mm a  $A_1 = 10$  mm;  $A_0 = 20$  mm a  $A_1 = 5$  mm;  $A_0 = 10$  mm a  $A_1 = 5$  mm;  $A_0 = 15$  mm a  $A_1 = 5$  mm. Experiments were provided by frequencies 1; 2; 4 Hz. Experiments were providing in laboratory of Department of Applied of Mechanics, Fig. 4.



**Figure 3: Scheme**

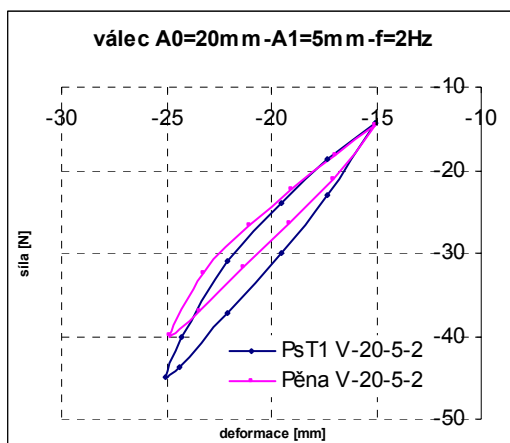


**Figure 4: Examined samples**

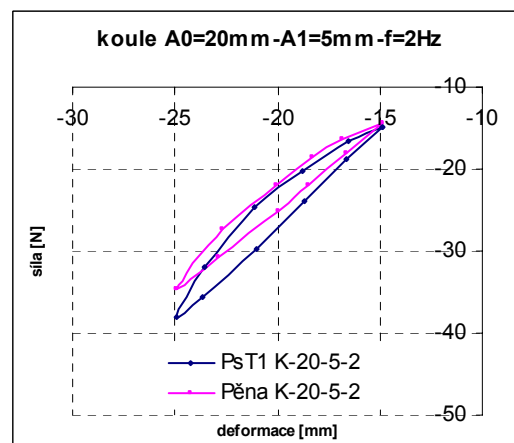
The area of hysteresis curve reflected dissipation energy (work). We changed input conditions and we followed increase and decrease dissipation energy, which was influenced by different input conditions; see Fig. 5 and 6.

As shown on pictures 5 and 6, is dissipation energy of foam upholstered by automobile textile higher than dissipation energy of self foam (see blue curve both picture). Blue hysteresis curve (the foam with automobile textile) indicates higher sharpness than red curve (separate foam), it means that is increased its value of stiffness of the foam with automobile textile. The area of hysteresis curve increased or decreased accordingly what kind of jaw is used for experiment

Because every kind of jaw absorbs different quantity of vibrations, we suppose, that every passenger of car absorbs different quantity of vibrations too. Therefore it is so important, that every passenger could change stiffness of upholstered seat of his choice.

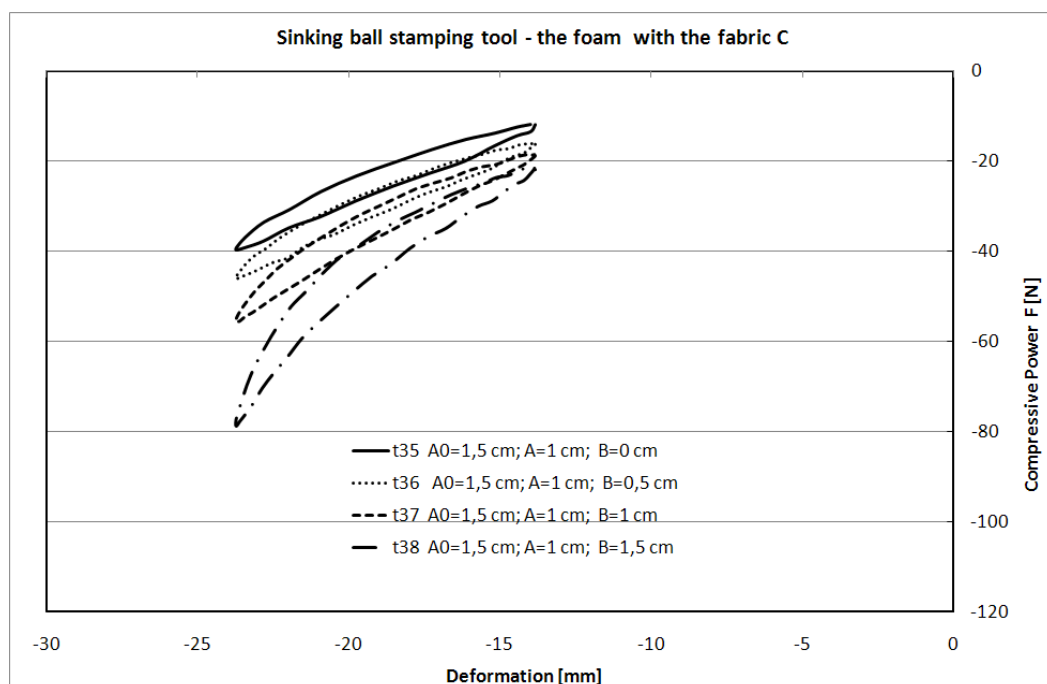


**Figure 5:** Form Ball



**Figure 6:** Form Cylinder

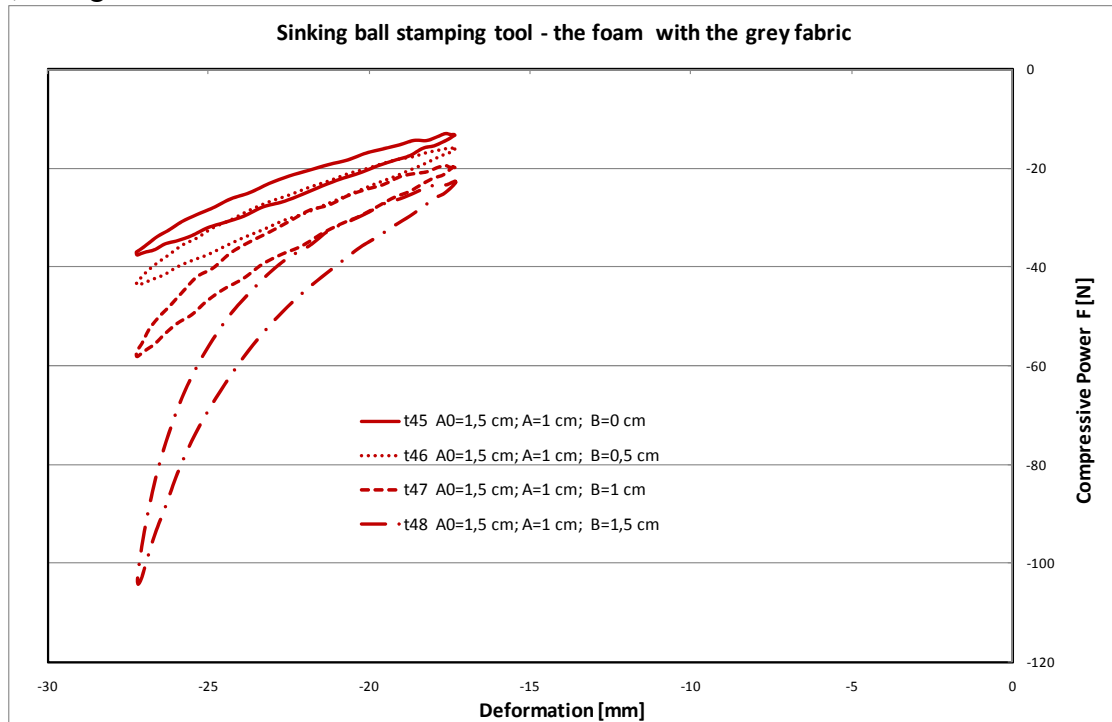
Next set of the experiment was realized with pre - stressed textile. Prestress has been realized in experiment so, that the pad strong 15 mm was inserted under foam. The foam was compressed in the pad and it evoked initial tension at the textile. As shown on Figure 7 and 8,



**Figure 7:** Examined sample with automobile textile - knitted

sharpness of the curve hysteretic markedly increased. Perhaps this is way to regulated stiffness of upholstered seating.

Now it is important find out, which have textiles acceptable properties for this kind of seat? That is why they were examined two sorts of textile samples. First was examined sample of automobile textile, see Figure 7. Prestressing increases stiffness of upholstered sample, which simulate upholstered seat. But the increment of stiffness was greater by the second textile, as Figure 8 shows.



**Figure 8:** Examined sample with grey textile - fabric

## 4. Conclusion

The stiffness seat isn't necessary regulate only by property of foam, the stiffness can be regulate prestressed of textile with foam, how it was shown by experimentation. The next development will orient on search of textile material acceptable for this type regulation, eventually we will project new acceptable textile material. The aim of research is the developing of simple way of the regulation of stiffness upholstered seat, so that all passengers could choose stiffness seat squab, which matches their bodily proportion.

## ACKNOWLEDGEMENT

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