

PNEUMATIC ENGINEERING AUTOMOBILE TOOLS AGAINST CRASHES

**Anelya Klisarova¹, Elka Radeva², Stanimir Karapetkov³,
Simeon Panev⁴, Atanas Mangarov⁵, Philip Philipoff⁶, Deian Rangelov⁷,
Blagovest Panev⁸, Daniela Arnaudova⁹, Diana Bankova¹⁰, Stoyan Velkosky¹¹**

¹Medical University-Varna, e-mail: klisarova@gmail.com

²Medical University-Sofia, e-mail: eliradeva@abv.bg

^{3,4}TU-Sofia, e-mail: skarapetkov@yahoo.com

⁵Infectious Diseases Hospital, e-mail: amangarov@gmail.com

⁶Institute of Mechanics: philip.philipoff@gmail.com

⁷STREZA EOOD, e-mail: dianrangelov@gmail.com

⁸LevIns, e-mail: blago_99@yahoo.com

⁹News Paper Maritca Plovdiv, e-mail: daniela666@abv.com

¹⁰SU-Sofia, e-mail: diana_bankova@abv.com

¹¹IGAPE, Nord Macedonia, e-mail: contact@igape.edu.mk

Key words: *Pneumatic Engineering Automobile Tools Against Crashes*

Abstract: *The pneumatic cover for the car is made by the respective company - manufacturer by inner tire. It is a multi-chamber pneumatic shell and has openings for: doors, car windscreens and headlights, rear-view mirrors, wheels. In seconds, he hopes for a stopped car and quickly inflates with the car's compressor, for example up to 2.2 atmospheres. It covers the car tightly and is a pneumatic shell throughout the car, increasing the size by 10–15 or 20 cm. When struck with another car with the same pneumatic cover, the accelerations are greatly reduced compared to the case of perfectly elastic impact due to the development of nonlinear deformations of the two pneumatic covers in the contact surfaces. The chance of slipping on impact is less than in the case of pneumatic armor, but in any case the accelerations at the moment of impact are small enough and do not endanger the life and health of the occupants of the two (or more) impacted vehicles. In certain places, safety valves are installed which, in the event of a sudden and very severe impact in local areas of the cloak, release some of the compressed air at a sudden pressure of more than 5 atmospheres (for example). The pneumatic cloak eliminates the possibility of damage to the structure of the car itself, even with very severe impacts due to the layer of compressed air in the chambers of the equipment, which, when impacted, deforms non-linearly and preserves both the life and health of the occupants and the structure of the vehicle itself. Additional local pneumatic shells may be affixed to the doors of the vehicle, which would protect the door structures from being struck sideways beyond the contours of the pneumatic cover itself.*

ПНЕВМАТИЧНИ ИНЖЕНЕРНИ СЪОРЪЖЕНИЯ ЗА АВТОМОБИЛ СРЕЩУ КАТАСТРОФИ

**Анелия Клисарова¹, Елка Радева², Станимир Карапетров³,
Симеон Панев⁴, Атанас Мангъров⁵, Филип Филипов⁶, Деян Рангелов⁷,
Благовест Панев⁸, Даниела Арнаудова⁹, Диана Банкова¹⁰, Стоян Велкоски¹¹**

¹Медицински университет - Варна, e-mail: klisarova@gmail.com

²Медицински университет - София, e-mail: eliradeva@abv.bg

^{3,4}Технически университет - София, e-mail: skarapetkov@yahoo.com

⁵Инфекциозна болница - София, e-mail: amangarov@gmail.com

⁶Институт по механика – БАН, e-mail: philip.philipoff@gmail.com

⁷STREZA EOOD, e-mail: dianrangelov@gmail.com

⁸ЛевИнс, e-mail: blago_99@yahoo.com

⁹Вестник Марица - Пловди, e-mail: daniela666@abv.com

¹⁰Софийски университет, e-mail: diana_bankova@abv.com

¹¹ИГАПЕ, Северна Македония, e-mail: contact@igape.edu.mk

Резюме: Пневматичният капак за автомобила е изработен от съответната фирма - производител от вътрешна гума. Представлява многокамерна пневматична обвивка и има отвори за: врати, автомобилни предни стъкла и фарове, огледала за обратно виждане, колела. За секунди се надява на спрял автомобил и бързо се надува с компресора на автомобила, например до 2,2 атмосфери. Той покрива плътно колата и представлява пневматична обвивка в целия автомобил, увеличавайки размера с 10–15 или 20 ст. При удар с друга кола със същия пневматичен капак, ускоренията значително намаляват в сравнение със случая на идеално еластичен удар поради развитието на нелинейни деформации на двата пневматични капака в контактните повърхности. Шансът да се изплъзне при удар е по-малък, отколкото при пневматичната броня, но във всеки случай ускоренията в момента на удара са достатъчно малки и не застрашават живота и здравето на обитателите на двете (или повече) засегнати превозни средства. Пневматичното наметало премахва възможността за повреда на конструкцията на самия автомобил, дори и при много тежки удари поради слоя сгъстен въздух в камерите на оборудването, който при удар се деформира нелинейно и запазва както живота, така и здравето на пътниците и структурата на самото превозно средство. Допълнителни локални пневматични черупки могат да бъдат прикрепени към вратите на превозното средство, които биха предпазили конструкциите на вратите от странични удари извън контурите на самия пневматичен капак.

1. Introduction

This report was written on an actual case on April 19, 2020 and is related to the death of the Bulgarian television journalist Milen Tsvetkov. The pneumatic car covers offered in the article will decrease terrible crash risk in Bulgarian roads.

2. Perfectly elastic or perfectly inelastic impact between two bodies

The mathematical modelling of dynamical systems by Method of Finite Elements could be seen at [1–11]. Here is given short description of Perfectly elastic or perfectly inelastic impact between two bodies. If considered an impact between two bodies with masses m_1 and m_2 , moving at speeds before the impact v_1 and v_2 , it is possible to obtain the speeds after the impact u_1 and u_2 .

From the law of conservation of the impulse (of movement of the two bodies dynamical system in the event of an elastic or inelastic impact between two bodies) it follows:

$$(2.1) \quad m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$$

The coefficient of recovery ($k = 1$ for a perfectly elastic impact and $k = 0$ for a perfectly inelastic impact) could be calculated by the formula:

$$(2.2) \quad k = \frac{u_1 - u_2}{(v_1 - v_2)}$$

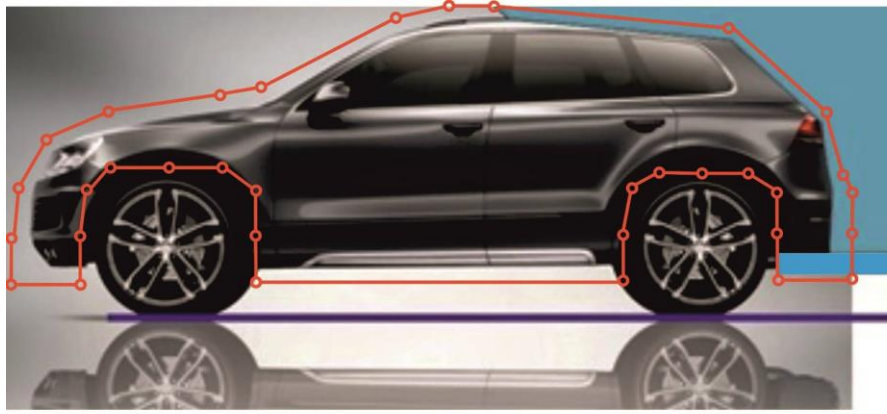
The velocities of the bodies after the impact u_1 and u_2 could be obtained according to the formulas as a result of solving of the system (2.1) – (2.2):

$$(2.3) \quad u_1 = v_1 - (1 + k) \frac{m_2}{(m_1 + m_2)} (v_1 - v_2)$$

$$(2.4) \quad u_2 = v_2 - (1 + k) \frac{m_1}{(m_1 + m_2)} (v_1 - v_2)$$

3. Crossroads in front of Paradise Mall in Sofia - 19 April 2020

Between 18:03 and 18:04 on Easter, an “Audi Q7” with three people in it hit the back of a “Subaru Forrester”, driven by Milen Tsvetkov. At least two street cameras filmed the crash. It is clear from the videos, that the accident nearly affected six pedestrians who crossed seconds earlier. According to the Emergency Service, the signal was given at 18:16 (at least 12 minutes after the incident). The ambulance arrived at 18:23. Milen Tsvetkov died on the way to “Pirogov Hospital”. The car that caused the impact, was moving at 140 km/h: $V_{\text{Audi Q7}} = 140 \text{ km/h}$ and $V_{\text{Subaru Forrester}} = 0 \text{ km/h}$ in the crash moment (allowed speed in a populated area 50 km/h !!!!!).



**PNEUMATIC COVER WITH OPENINGS FOR:
DOORS, FRONT AND REAR WINDOWS OF
THE CAR, HEADLIGHTS,
REAR-VIEW MIRRORS, WHEELS.**

Fig. 1. Pneumatic cover



Fig. 2. Pneumatic armor

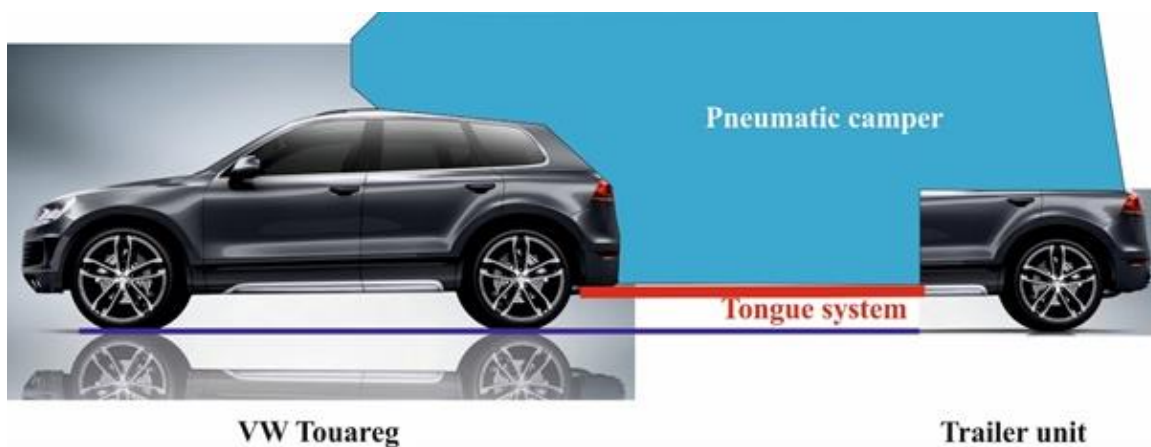


Fig. 3. Pneumatic camper. This advanced automobile structure could be combined with the Pneumatic Cover.

4. Conclusion

Offered pneumatic car equipment will minimize casualties on the roads of Bulgaria in strict compliance with the speed limits prescribed in the Bulgarian Road Traffic Act (in Bulgarian).

Последно обновяване: юни 2017 г.

Ограничения на скоростта в България

ППС от категория	В населено място	Извън населено място	Автомагистрала	Скоростен път
A	50	80	100	90
B	50	90	140	120
C, D	50	80	100	90
BE, CE, DE	50	70	100	90
T	50	50	-	-
M	45	45	-	-
Самоходни машини	40	40	-	-

Acknowledgements

The authors express their acknowledgement for the financial support of this study by the grant COST Action ES1301 FLOWS and special acknowledgement to Bulgarian companies STREZA Ltd (<http://streza.bg>) and PENTAHRON Ltd (<http://pentahron.eu/lang/bg/architecture/>) for the financial support of the study.

References:

1. Bushev, S., S. Stefanov, K. Ishtev, Ph. Philipoff, (1994), Processes of Shot Peening Mechanics, Comptes rendus de l'Academie Bulgare des Sciences, Physique, Tome 47, N 11, IF = 0,343, pp. 9–12.
2. Philipoff, Ph., N.Shopolov, K.Ishtev, P.Dineva, (1997), Wave Propagation in Multilayered Media, Pergamon, Nonlinear Analysis, Theory, Methods & Applications, Vol.30, No.4, IF = 1,405, pp. 2031–2040.
3. Philipoff, Ph., Ph.Michaylov, (2007), BELENE Nuclear Power Plant Numerical and Experimental Bedrock, Layers and Surface Signals, J. Applied Mathematical Modeling, Elsevier, Vol. 31, Issue 9, September 2007, IF = 1,766, pp. 1889–1898.
4. Kurteva, Maya, Philip Philipoff, Dimitar Dimitrov, (2009), Assessment of Some Elements of Environmental Risk Factors in the Bulgarian Mountains, Comptes rendus de l'Acad'emie bulgare des Sciences, Tome 62, Number 6, IF = 0,343, pp. 745–752.
5. Philipoff, Ph., D.Demirev, A.Yusuf, M.Islam, D.Stankov, D.Bankova, Ph. Michaylov (2010). Some Psychology and Technical Aspects of a Rescue Operation in the Musala Peak Region (Rila Mountain), Procedia Social and Behavioral Sciences, Elsevier, WCPCG-2010.
6. Jivkov, Venelin, Philip Philipoff, Anastas Ivanov, Mario Mucoz, Galerida Raikova, Mikhail Tatur, Philip Michaylov. "Spectral properties of quadruple symmetric real functions", Applied Mathematics and Computation – Elsevier, IF = 1,766, 221 (2013), pp. 344–350.
7. Jivkov, V., Philipoff, Ph., Nikolov, N., Velocities in Contact Area of Turning Elastic Tires, (2016) Journal of the Balkan Tribological Association, Vol. 22, N 3-1, 2016, ISSN 1310-4772, IF = 0,737, pp. 2210–2217.
8. Jivkov, V., Nikolov, N., Philipoff, Ph., Wheels Slip Angeles in a Hybrid Vehicle with KERS During Movement in a Turn, (2017) Journal of the BalkanTribological Association, book 1, Vol. 23 (2017) of J Balk Tribol Assoc, IF = 0,737.
9. Jivkov, V., Natarajan V., Paneva A., Philipoff, P., (2017) Forecasting of Strong Earthquakes M>6 According to Energy Approach. J Earth Sci Clim Change, IF = 1,161, 15 Dec. 2018, 8: 433. doi:10.4172/2157-7617.1000433
10. Venkatanathan Natarajan, Philip Philipoff, (2018). Observation of surface and atmospheric parameters using "NOAA 18" satellite: a study on earthquakes of Sumatra and Nicobar Is regions for the year 2014 (M > 6.0), Springer Science+Business Media B.V., part of Springer Nature 2018, Received: 7 May 2015/Accepted: 22 February 2018.
11. Philipoff, Philip. Structural Methods for Solving Some Boundary Value Problems, Senior Dr of Sci Dissertation (Project), VSU Liuben Karavelov, Sofia, 2018 (in Bulgarian).