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Editors: Prof. dr ***Aleksandra Janković****; Prof. dr* ***Čedomir Duboka***

MVM *Editorial Board*
University of Kragujevac
Faculty of Mechanical Engineering
Sestre Janjić 6, 34000 Kragujevac, Serbia
Tel.: +381/34/335990; Tel.: 336002; Fax: + 381/34/333192

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[1] DEVELOPMENT OF ALGORITHM FOR REDUCTION OF FUEL CONSUMPTION AT LIGHT DUTY MOTOR VEHICLES

Boran Pikula, Ivan Filipović, Dževad Bibić, *Mechanical Engineering Faculty University of Sarajevo, Sarajevo, Bosnia and Herzegovina*

UDC: 004.942:662.75]:629.114

Abstract

Light duty vehicles become more popular in goods distribution, especially in urban areas like downtowns or zones where traffic is limited or closed completely. In the same time, use of light duty vehicles is reasonable in case of non-stationary vehicle motions like acceleration and braking due to traffic jams and traffic lights. These situations lead to greater fuel consumption.

In order to solve the mentioned problem, measurements of non-stationary urban driving cycles had made and after analysis, the algorithm was developed. The algorithm was the base for development of software that, based on information from vehicle's CAN BUS, makes possible practical realization of optimal fuel consumption on a light duty vehicle.

Key words: vehicle, fuel consumption, eco drive.

RAZVOJ ALGORITMA ZA SMANJENJE POTROŠNJE GORIVA KOD LAKIH DOSTAVNIH MOTORNIH VOZILA

UDC: 004.942:662.75]:629.114

Rezime: Laka dostavna vozila postaju sve više zastupljena u distribuciji roba, posebno u urbanim gradskim područjima ili zonama ograničenog saobraćaja ili u potpunosti zabranjenog saobraćaja. U isto vreme, upotreba lakih dostavnih vozila je posebno opravdana u slučaju nestacionarnih uslova kretanja vozila tokom ubrzanja i kočenja, zbog saobraćajnih gužvi i rada svetlosnih sistema za upravljanje saobraćajem (semafori). Navedene situacije dovode do povećanja potrošnje goriva.

S ciljem rešavanja spomenutog problema, izvršeno je snimanje nestacionarnih uslova kretanja vozila (ciklusi), a nakon analize je napravljen algoritam. Ovaj algoritam je bio osnova za razvoj kompjuterskog programa, koji na osnovu informacija dobivenih od CAN BUS mreže vozila, omogućava praktičnu realizaciju optimalne potrošnje goriva kod lakih dostavnih vozila.

Ključne reči: vozilo, potrošnja goriva, ECO vožnja.

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DEVELOPMENT OF ALGORITHM FOR REDUCTION OF FUEL CONSUMPTION AT LIGHT DUTY MOTOR VEHICLES

Boran Pikula*[1]*, Ivan Filipović*, *Dževad Bibić

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INTRODUCTION

The development of modern motor vehicles is based on increasing the power and the torque of IC engine providing improvement of the vehicle dynamic properties what can be carried out only by introduction of the new technical and technological solutions in the power train. Thereby, special attention is dedicated to reduce the fuel consumption and the pollutants emissions. Considering light cargo delivery vehicles, insisting to increase the mass of the empty vehicle and its load capacity is the priority. The solution of those complex demands mentioned above is generally the compromise for a car manufacturer, which is confirmed through the certification testing of the vehicle. But, how does it look in the reality? Does the exploitation of some light cargo delivery vehicle truly confirm the results of the certification testing? How much each driver can participate in the realization of such heavy task? Finally, the most important, is it possible to manipulate by costs during exploitation of the vehicle regarding the fuel consumption? Having in mind these questions, a realization of the following objectives will be presented in the paper:

1. Make the calculation of the fuel consumption during vehicle driving by different driving cycles.
2. Perform the analysis with a view to define optimal drive regarding to fuel consumption.
3. Define parameters in order to obtain optimal drive conditions considering the fuel consumption.
4. Recommend the algorithm to obtain an optimal drive that leads to reduce of fuel consumption.

DEFINITION OF FUEL CONUMPTION FOR TEST VEHICLE

For this purpose, a one light duty motor vehicle is chosen. Having in mind the limited number of pages for this paper, the technical data of the light duty motor vehicle can be easily found in [5]. In order to perform further fuel consumption analysis of the light duty cargo delivery vehicle it is necessary to obtain the diagram of the constant specific fuel consumption (g_e) as a function of engine speed and engine load i.e. mean effective pressure (p_e). This diagram, with the constant specific fuel consumptions from 240 to 800 g/kWh, is shown in the Figure 1.

[1] Corresponding author e-mail: pikula@mef.unsa.ba, Mechanical Engineering Faculty University of Sarajevo, Department for IC Engines and Vehicles, Vilsonovo setaliste 9, 71000 Sarajevo, Bosnia and Herzegovina

Starting from the motor vehicle, general equation of the vehicle movement can be written in the following form:

$$\sum R = R_f \pm R_u + R_z \pm R_j = m\,g\,f\cos\alpha \pm m\,g\sin\alpha + \frac{1}{2}c_x\,A\rho v \pm m\lambda_{mj}\,\frac{dv}{dt} \qquad (1)$$

where are m - vehicle mass, g - ground acceleration, α - road grade, c_x – air drag coefficient, A - vehicle frontal area, v – velocity, ρ - air density, λ_{mj} - rotating component mass coefficient. Inserting known rolling radius of the tire r_d , total propulsion moment at the ground M_T can be written as:

$$M_T = F_T r_d = \sum R\, r_d = \left[m\,g\left(f\cos\alpha \pm \sin\alpha\right) + \frac{1}{2}c_x\,A\rho v \pm m\lambda_{mj}\,\frac{dv}{dt}\right]r_d \qquad (2)$$

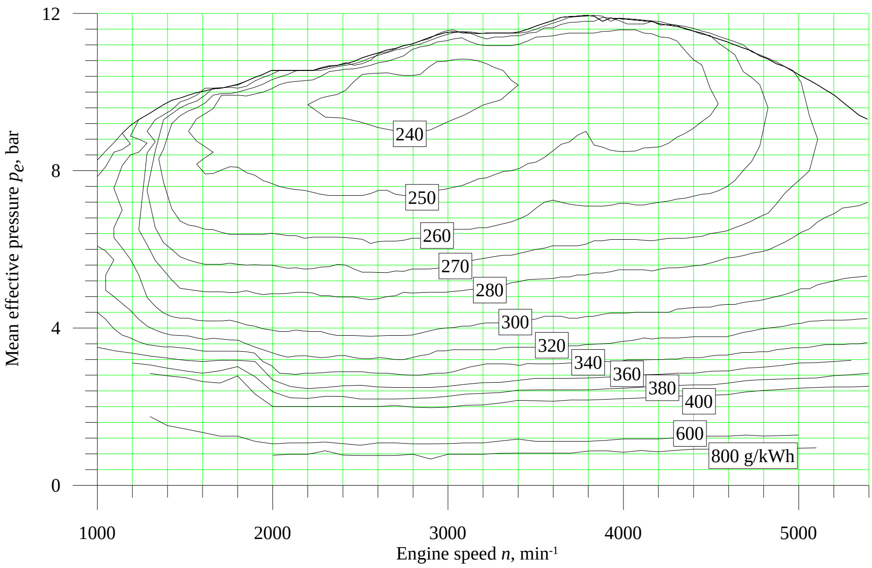

Figure 1: *Original fuel consumption diagram*

Considering the correlation between effective engine torque and the propulsion moment at the ground always persists, knowing total transmission ratio i_T and efficiency of the transmission η_T, the following equation can be given by:

$$M_e = \frac{M_T}{i_T\eta_T} = \frac{\left[m\,g\left(f\cos\alpha \pm \sin\alpha\right) + \frac{1}{2}c_x\,A\rho v \pm m\lambda_{mj}\,\frac{dv}{dt}\right]r_d}{i_T\eta_T} \qquad (3)$$

From the expression above the direct correlation between road resistances incorporated in the engine torque value M_e that is used for the motor vehicle movement is obvious. On the other hand, using kinetic correlations, engine *rpm* by which it generates the engine torque needed to overcome total road resistances can be defined by:

$$\omega = \frac{i_T\, v}{r_d} \quad \Rightarrow \quad n = \frac{\omega}{2\pi} \tag{4}$$

When the values of the engine torque needed to prevail road resistances are clearly defined as well as the corresponding engine *rpm* as a function of total transmission ratio i_T, applying the interpolation method and digitalized form of the fuel consumption diagram given in the Figure 1, the current values of the specific consumption g_e for the related case of the vehicle movement can be calculated.

Thus, with a known density fuel value, the hourly fuel consumption in the volumetric units can be defined as:

$$Q = \frac{G_h}{\rho} = \frac{g_e Pe}{\rho} \quad \left[\frac{l}{h}\right] \tag{5}$$

Finally it is possible to determine the road travel fuel consumption closer to everyday motor vehicle driver, i.e. fuel consumption by travel made in *l/100 km* by following expression:

$$Q_{l/100\mathrm{km}} = Q\frac{100}{v} \quad \left[\frac{l}{100km}\right] \tag{6}$$

DEFINITION OF FUEL CONSUMPTION IN ONE URBAN CYCLE

Unified conditions of the engine parameters and the driving parameters of the vehicle are always present problem, not only to determine the fuel consumption but to determine emission of pollutants too. So, these conditions are defined by the corresponding cycles since the early 50s of the last century. The cycles defined by ECE R15 regulations, modified and agreed with the real driving conditions of the vehicle have special importance during the last 2 decades in the Western Europe.

Considering that the fuel consumption, determined during non-stationary driving conditions by given cycle, presents one of the numerous certification tests, by this the fuel consumption values are clearly defined. On the other hand, different road configurations aren`t and cannot be included within this cycle, as well as the different driving methods (cases) that the optimal fuel consumption is defined. Therefore, the driving cycles recording along the same test track in the urban area has done by the different driving methods (cases) i.e. the gear shift for different engine speeds. Besides this test track, driving cycles are recorded, based on CAN BUS and GPS data, for case of driving by various speeds on the open road and along the highway.

Calculation of the fuel consumption was carried out for all of the driving cycles recorded like: driving uphill, horizontal road drive and „open“ drive – intercity drive. In order to determine the fuel consumption, the biggest road grade of 4.29 % was chosen along the test track in the urban area and presented in this paper.

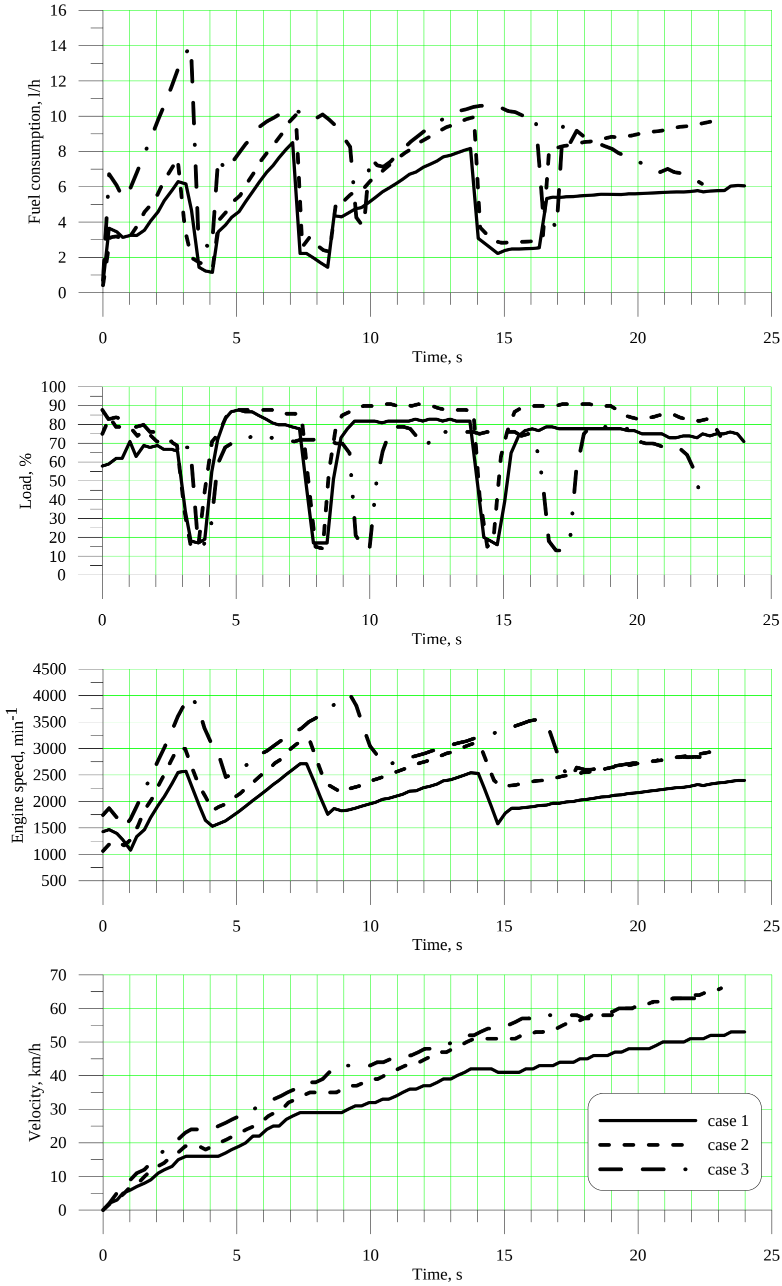

Figure 2: *Comparison display of the specific parameters by different driving cases driving uphill along the road grade of 4.29 %*

The Figure 2 shows the realized driving cycles on the same test track and by different ways of driving and obtained results through the both of the cases. Simulation of the various driving cases is imagined to be through the different cases of the gear shifting during the acceleration of the vehicle. The first driving case tend to be by shifting gear around 2500 min^{-1} engine rpm during acceleration, the second driving case is to shifting gear by engine rpm of 3000 min^{-1} during the acceleration of the vehicle, although the third driving case is to shifting gear by engine rpm of 4000 min^{-1} in the first and second gear, until it depends on traffic conditions regarding the other gears shifting, and it is carried out in the range of 3000-3500 min^{-1}.

The clearer picture about the impact of different driving cases over the same test section comparing the results offers the Figure 2. It can be seen in the Figure 2 that if the gear shift is carried out later, i.e. achieved by higher engine speed in each of the respective gears, the vehicle performs better dynamic properties in terms of the resulting acceleration of the vehicle. This is the best illustrated in the vehicle speed diagrams as a function of the engine speed. It has to be noted that the driver pushed down the gas pedal evenly through the all driving modes and it is clearly visible on the load diagram.

However, the first diagram in the Figure 2, referring to the values of the current fuel consumption, shows certainly the most interesting part of this analysis. Apparently the price of better dynamic properties of the vehicle, achieved by the gears shift at higher engine speed, is pay by the vehicle customer through the higher current fuel consumption but through the total fuel consumption as well driving by given section.

Keeping in mind the total fuel consumption consumed during the acceleration with different driving cases along the test track the average fuel consumption along the travel made can be defined. The overview of the average fuel consumptions values is shown in the table 1.

Table 1: *The fuel consumption refers to different driving cases*

Driving cycles	Travel during acceleration, *km*	Fuel consumption, *l/100 km*
Case 1	0.248	20.42
Case 2	0.248	22.42
Case 3	0.240	25.06

Although the road traveling fuel consumption values expressed in *l/100km*, on the first sight, seems to be significant, higher than normal road travel fuel consumptions given by the catalogs and displayed by onboard computers but here is important to note that it is about values relevant in the case of the vehicle acceleration driving uphill along the road grade of 4.29%.

The relative fuel consumption, defined in order to implement the analysis of fuel consumption by various driving cases, is shown in the table 2.

Table 2: *Relative fuel consumption by various driving cases*

Driving cycles	Relative fuel consumption, %	Increase of the consumption, %
Case 1	100.00	0.00
Case 2	109.79	9.79
Case 3	122.72	22.76

Based on presented results, it can be concluded that if the gear shift is carried out earlier during acceleration of the vehicle, significant effect to the fuel consumption can be realized, but to the dynamic characteristics of the vehicle as well. It is well known that the gear shift at lower engine speed, especially driving uphill, depends on the experience of the driver and his skills to do it fast enough on that way to vehicle achieves stable drive in the next gear. For this reason, it is necessary to ensure the optimal engine speed to the gear shift what will be analyzed through the further specific driving cases. As an example, if the driving case number 2 is optimal, it would increase the fuel consumption by 11.78% between driving case number 3 and driving case number 2.

The same conclusions were obtained in analysis of fuel consumption during acceleration on the horizontal road. The special attention is dedicated to „open drive" – intercity drive. Based on the conducted analysis, the determination of the influenced parameters had done, as well as definition of optimal drive regarding fuel consumption.

DETERMINING OF THE INFLUENCED PARAMETERS

Based on the calculation results of the fuel consumption during the cargo delivery vehicle movement by the recorded driving cycles in the urban area, with characteristic of non-stationary ride conditions with a frequent accelerations and decelerations along the strait road, but along the road with the grade angle also, driving cycles of the vehicle in the intercity routes and by the highway as well, corresponding parameters affecting fuel consumption can be defined:

1. *Acceleration of the vehicle* is the most important influenced parameter during non-stationary ride in the urban area. Extreme acceleration is very common followed by extreme deceleration in urban area what suppose to be a consequent influenced parameter by many explorers. Due to that, from big importance is:

    a) In order to avoid extreme acceleration of the vehicle it is necessary to push down gas pedal rationally as possible to have a control by *engine load* values, i.e. by *gas pedal position*

    b) Besides engine load, avoiding of extreme vehicle acceleration is possible to achieve by shifting gears earlier, i.e. shifting gears on lower *engine RPM*.

2. The most important parameter during non-stationary ride in urban area and the intercity routes and by the highway is *driving speed* and *the information about which of the gears is running*. Therefore, the fact known well is that by driving

speed of 90 km/h, the vehicle running in the 5th gear accomplishes lower fuel consumption then the vehicle running in 4th gear, etc.

3. *Road configuration* can have a significant influence to the fuel consumption. Thereby it is necessary to make a difference between the uniform strait linear and curvilinear vehicle movement with possibilities to rich lower vehicle speed. Apart from vehicle movement path, very important influenced parameter is the *road grade*, and it is difficult to determine it. Information about road grade is available by modern and very accurate GPS devices, but installation is doubtful because of its high price. However, information about axle loads can be useful to determine the road grades, but considering change of loads over the acceleration, i.e. over deceleration of the vehicle, its accuracy can be under question. Finally, due to determined vehicle acceleration and engine load, required information about road grade can be obtained, but it takes a lot of data that must be processed by computer with some presumptions, thus it will not be used in the further analysis.

DEFINING OF THE OPTIMAL DRIVE

The best illustrated view of defined optimal drive is algorithm shown in the Figure 3. The presented algorithm can serve to assemble the computer program that will enable to achieve optimal drive and fuel consumption of the light duty motor vehicle.

Considering influenced parameters mentioned in the last chapter, the following method to accomplish optimal drive can be proposed:

- Analyzing the shape of the fuel consumption diagram, it can be noted that the constant specific fuel consumption curves reach minimal values in the range of 2500 – 3000 min^{-1}. Although, analyzing the results affecting the fuel consumption during different drive cases, i.e. different engine speed shifting gears, it can be concluded that minimal values has reached throughout the first driving case, i.e. by shifting gear at 2500 min^{-1}. Since shifting gears by this engine speed enables stable ride in the next gear, even traveling uphill, shifting gears from 1st gear to 2nd, from 2nd to 3rd, from 3rd to 4th and finally from 4th to the 5th gear has to be done exactly by this rpm. In this case, this provides to driver get the information about necessity to shift gear, because of „total inertia“ the shifting gear could be by something higher engine speed, let`s say about 2800 min^{-1} where the engine runs still with minimal specific fuel consumption.

- The minimal engine speed necessary to obtain the gears shift from 5th to 4th, from 4th to 3rd, and finally from 3rd to 2nd gear amounts 1200 min^{-1}.

- In order to make registration sudden vehicle decelerations, due to extreme accelerations, driver reaction coming out late and beginning to brake, etc., because that can lead to intensive wear of the friction surfaces on the break surfaces, continuous acceleration i.e. deceleration is recommended. According to data in [8], common deceleration values amounts about 2.0-2.5 m/s^2. According to latest experiments, common ordinary deceleration values today amounts about 2.5-3.0 m/s^2. Considering eventual error of the calculated deceleration because of rounded values of velocity of the movement and short interval of time (less than 1s), and because of the inertia of system as well, registration of all vehicle deceleration values over 4 m/s^2 is recommended.

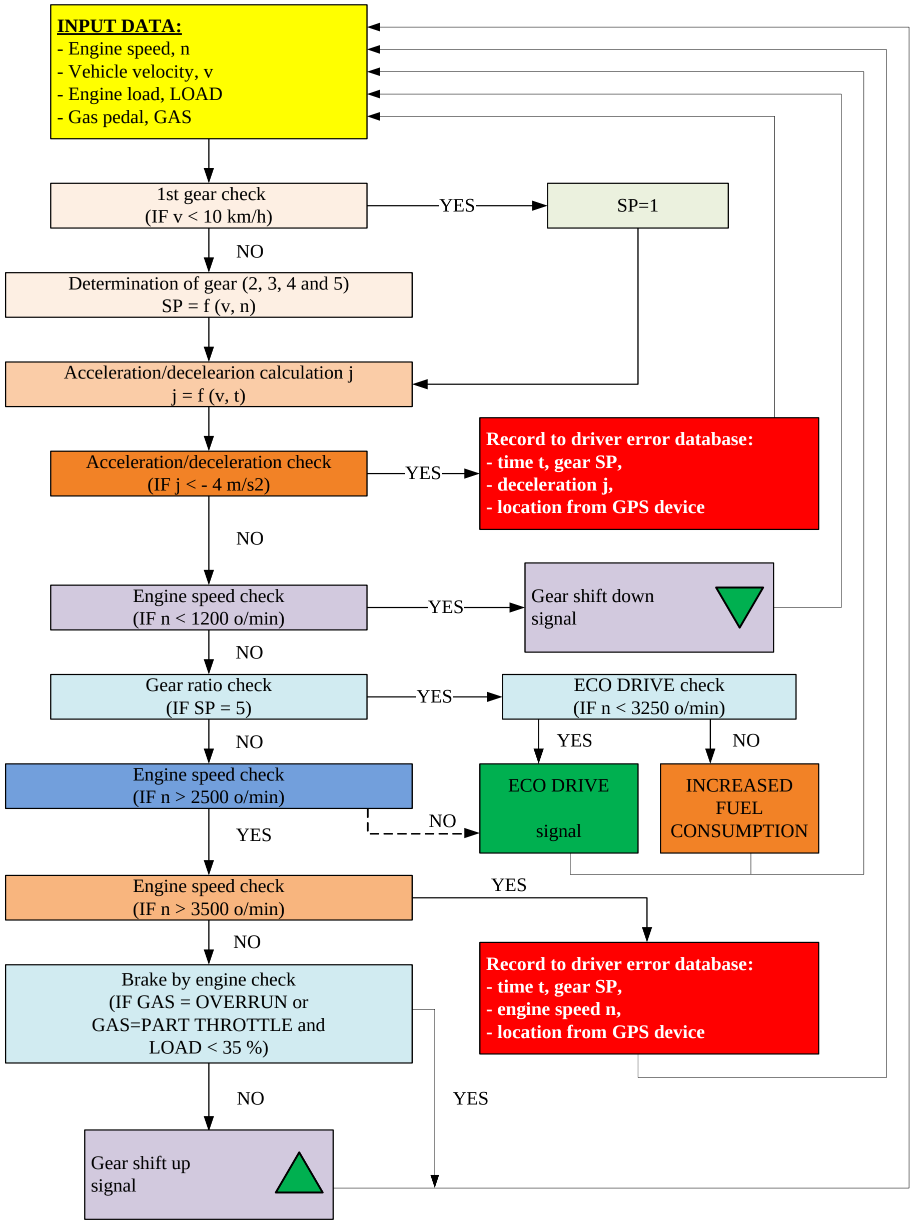

Figure 3: *Algorithm to achieve the optimal drive and optimal fuel consumption*

- Having in mind a fact that during vehicle motion downhill could happen the ride with the engine speed that corresponds to recommended engine speed to shift to the next gear, for ex. from 2nd to 3rd, from 3rd to 4th, from 4th to 5th, this situation can lead to the additional acceleration of the vehicle reducing-in the break-by-engine effect. That is the reason why the engine load information are so important as well as the information about gas pedal position. Assuming the values OVERRUN or PART THROTTLE are registered by the gas pedal position or below the engine load of 35%, it is not necessary to signalize shifting gears.

- If the engine runs above 3250 min^{-1} during the ride of the vehicle by constant velocity in the 5^{th} gear, warning about the increased fuel consumption is obtained, i.e. uneconomic ride.

CONCLUSIONS

In order to provide more realistic image about exploitation of the light duty motor vehicle, recording of driving cycles with different cases of the ride in the downtown along various road configuration (strait road, uphill, downhill), but also in the intercity ride and by the highway has done. Recorded cycles have been used into the purpose for calculation of the fuel consumption pointed-out on the influenced parameters by the aspects of fuel consumption.

Considering obtained parameters, fuel consumption diagram of the engine using the petrol like driving fuel, results of the calculation and analysis carried out by the aspects of fuel consumption, algorithm is made for making of the computer program of the optimal ride for the light duty motor vehicle.

In the realization of the optimal ride, the problems in the case of the complex road configurations may appear such as: extreme uphills, narrow traffic lanes along the road with a significant number of the curves, etc. Considering the problems to determine road grade described before, complex calculation of the optimal ride and demands for the computer capacities, different capabilities of the driver regarding fast changeover the gears driving upwards, advice to the drivers in the situations mentioned is the next: the ride, engine load and engine speed and the gear is running adjust to obtain the stable and the safe ride.

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[1] DETERMINATION OF TOTAL NOISE LEVEL IN THE MOTOR VEHICLE

Jasna Radulović, Dragan Taranović, Gordana Bogdanović, *Faculty of Mechanical Engineering from Kragujevac, Kragujevac, Serbia*

UDC: 534.83:629.113
614.872:629.113

Abstract

One of the main acoustic problems regarding motor vehicles is the identification if individual sources of noise level which the passanger percieves as a global level. Thereby, one should have in mind that the total noise in vehicle represents the loghatitmic sum oh components, not the algebric one. If the identification of noise sources is performed, i. e. the noice sources are qualified as coherent or incoherent, it is possible to carry out the analysis of global signal by summing of multiple sources of noise. The influence of individual sources to the total signal can be obtained using analysing of global signal.

Key words: Noise level**,** Coherent signal, Incoherent signal.

ODREĐIVANJE UKUPNOG NIVOA BUKE U MOTORNIM VOZILIMA

UDC: 534.83:629.113
614.872:629.113

Rezime: Jedan od glavnih problema akustike kod automobila je identifikacija pojedinačnih izvora nivoa buke koje putnik registruje kao globalni nivo. Pri tome treba imati u vidu da ukupna buka u vozilu ne predstavlja algebarski već logaritamski zbir komponenata. Ukoliko se izvrši identifikacija izvora buke, tj. njihova kvalifikacija na koherentne i nekoherentne, moguće je izvršiti analizu globalnih signala sabiranjem više izvora buke. Uticaj pojedinačnih izvora na ukupan signal može se odrediti korišćenjem analize globalnih signala.

Ključne reči: nivo buke**,** koherentni signal, nekoherentni signal.

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614.872:629.113

INTRODUCTION

Engine functioning and vehicle motion on the road bring about the emergence of noise and vibration. The noise and vibrations produced by a motor vehicle are a result of a simultaneous influence from many sources, and, thus, the efficient reduction of them is possible only in the case of inspecting each source separately, and then doing an overall analysis of the problem [1, 2].

Engine and its supporting parts are a complex system of noise production. The engine noise appears as a result of the action of force originating from a mechanical source and action of gases onto the piston during the functioning process of the internal combustion engine. The passenger in the vehicle is exposed to a noise level which is a result of a general acoustic pressure appearing as a sum of various "primary" and "secondary" sources of noise [3, 4].

Primary noise sources originate mainly from:

- The noise and vibrations of the engine,
- The noise which is a consequence of the vehicle moving along various types of surface,
- The noise of an aerodynamic origin and
- The noise which is produced during the functioning of different vehicle parts and aggregates.

Primary noise is transferred partly directly through the supporting element of a vehicle, partly through various channels, ports, slots, etc., and partly by vibrating of smaller and bigger areas of the vehicle body which are on the way of sound waves.

The impulse which causes secondary noise, the body vibrations, originates from the effects of engine, rubber and metal elements, wheel motion over an uneven surface, exhaust system vibrations, streaming of the air over the vehicle during the motion. Secondary noise could appear as more intensive when the impulse has the components of frequency which respond to the resonance of the vehicle body parts or the enclosed space.

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[1] Corresponding author e-mail: jasna@kg.ac.rs, Faculty of Mechanical Engineering, Kragujevac, Serbia

Vehicle noise is directly dependent on the movement speed, gear, vehicle load, type of road surface, driving style, coefficient of streamlining, condition of the windows (open, partially open or close), heating and ventilation system functioning, vehicle production quality, characteristics of tires, etc.

All noise which is produced during drive aggregate functioning stands in a direct correlation with revolutions-per-minute of the crankshaft. The increase of revolutions-per-minute of the crankshaft causes the higher level noise.

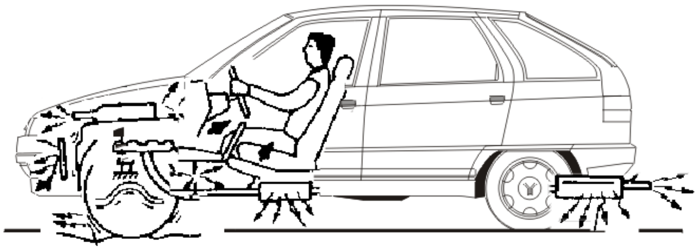

Figure 1: *Major noise and vibration sources*

Depending on the frequency characteristics of the produced noise and vibrations, the noise sources could be characterized as coherent and noncoherent.

Coherent sources of the sound waves are qualified by the same frequency and the same or different phase. An illustrative example could be a result of drive aggregate vibrations which act at the places of its location and the noise from the process of combustion. The parts of sound waves which pass through various environments but originate from one source could be considered coherent. E.g. the noise coming from the engine which passes through the air environment or through the engine prop to the body also belongs to the group of coherent acoustic waves.

Noncoherent sources are those sources which have the level of the sound whose frequencies are not identical. E.g. two noncoherent sources could be engine noise and aerodynamic noise.

NONCOHERENT SOURCES

Regarding complex sound waves which involve many noncoherent sources, it is necessary to determine an effective value of the sound pressure which contains many different acoustic pressures, waves which take part in the complex sound. The current value of the complex sound pressure is obtained as a square root of the sum of the squares of the current values of the pressure of the waves which take part in that complex sound:

$$p_u = \sqrt{p_1^2 + p_2^2 + \cdots + p_n^2} \tag{1}$$

so that:

p_u - current value of the complex sound pressure, $p_1, p_2, \ldots p_n$ - acoustic pressures of the complex sound components.

Level of sound pressure is calculated by applying the formula (2):

$$L = 20 \log \frac{p_u}{p_0} \text{, dB} \qquad (2)$$

for p_u - current value of acoustic pressure,

$p_0 = 2 \cdot 10^{-5}$ N/m^2 – reference value of acoustic pressure.

As for two sound sources, the global level of the sound could be calculated by applying the formulae (1) and (2). According to these formulae, it is possible to make a graph of increase of the overall level of the complex sound depending on the value of subtraction of the sound level of every single component. That graph is very commonly applied in practice because it offers a solution in a quick and simple way (Figure 3). If two sources are placed at the points A and B, figure 2, with the point A sound level L_A expressed in dB, and the point B sound level L_B expressed in dB, then the point 0 sound level L_T expressed in dB is obtained according to the formula (3) by using the graph in Figure 2.

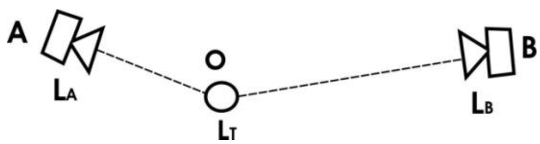

Figure 2: *Case with two noncoherent sources*

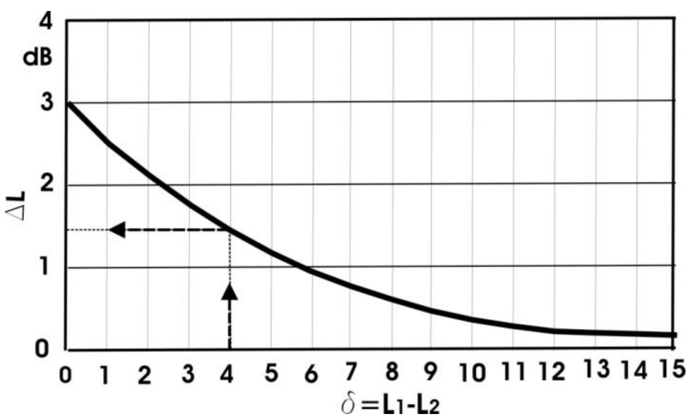

Figure 3: *Graph of logarithmic addition*

$$L_T = L_A + \Delta L \text{, dB} \qquad (3)$$

Supposing that $L_A > L_B$, one can calculate $\delta = L_A - L_B$, so that ΔL can be simply calculated from the diagram in the Figure 3.

Regarding two sources of the same level, the global level is obtained by adding 3 dB to the level of one of the sources, which can be easily concluded from the Figure 3. In practice, if the difference between the levels of two sources is bigger than 10 dB, then δ <0,5 dB, and the influence of the lower level source can be neglected.

Summation of several noncoherent sources is of great importance in practice, especially for global noise level reduction by sound insulation.

The examples of three or four noise sources can illustrate the influence of sound insulation applying.

As for three noncoherent sources with different levels, it is very important to know the noise levels of individual sources. Figure 4 shows an example of summation of sound coming from three sources.

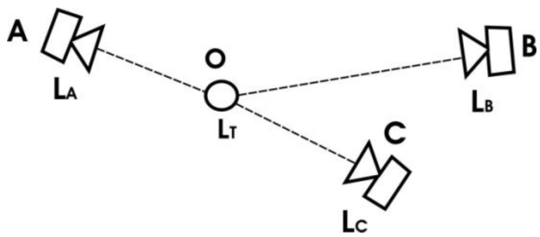

Figure 4: *Case with three noncoherent sources*

Table 1 shows noise levels from three sources and overall noise level L_T, before applying sound insulation and their levels after insulation of individual sources and all the sources.

Table 1: *Results of logarithmic addition for three sources*

	L_A	L_B	L_C	L_T	ΔL
Level, dB	85	80	75	86,5	-
Insulation L_A	65	80	75	81,3	5,2
Insulation L_B	85	60	75	85,4	1,1
Insulation L_C	85	80	55	86,2	0,3
Ins. $L_{A,}$ $L_{B,}$ L_C	65	60	55	66,5	20

Primary isolation is the isolation of the source of the highest level, just like it is shown in the Table 1, where the reduction of noise level of 10 dB gave a global noise level reduction of 5,2 dB. Isolation of the source of a lower level often can be wasteful because the results are negligible, so that the reduction of noise level of 20 dB at the noise source with the lowest level would achieve the reduction of 0,3 dB. The best solution is to insulate all the sources, if possible.

Also, an example with four sources with the same level, which is shown in the Figure 5, is illustrative. The results of the analysis are given in the Table 2.

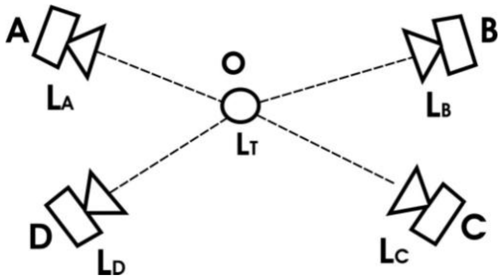

Figure 5: *Case with four noncoherent sources*

As a result of the effect of four sources with the same level, the global level will be higher for 6 dB in comparison with the effect of only one source. If we apply sound insulation to reduce one source level for 20 dB, the global level will be reduced for 1,2 dB. However, if the levels of three sources are reduced for 20 dB, the global level will be lower for 5,9 dB. The best results appear in the case of simultaneous insulation of all the noise sources.

Table 2: *Results of logarithmic addition for four sources*

	L_A	L_B	L_C	L_D	L_T	ΔL
Level, dB	80	80	80	80	86,0	-
Insulation L_A	60	80	80	80	84,8	1,2
Insulation L_A ,L_B	60	60	80	80	83,1	2,9
Ins. L_A ,L_B, L_C	60	60	60	80	80,1	5,9
Ins. L_A,L_B,L_C,L_D	60	60	60	60	66,0	20,0

COHERENT SOURCES

As for coherent sources, the sources of the same frequencies but variable phase, the rule of the sum of the squares of sound pressure effective pressures is not applied like it was the case with noncoherent signals. Considering coherent waves, the summation is done with regard to the interference of two or more waves, and their final sum does not depend on oscillation amplitude only, but on their phase difference, too. In the case of coherent sources, phasor addition is done, where the phasor module is proportional to the sound pressure, and phasor angle (argument) is determined by the phase. The Figure 6 presents the way of summing two coherent signals of the same acoustic pressure, but of different phases in a time domain. If two sources are of the same phases and levels then the resulting noise is two times higher, while the phase remains unchanged.

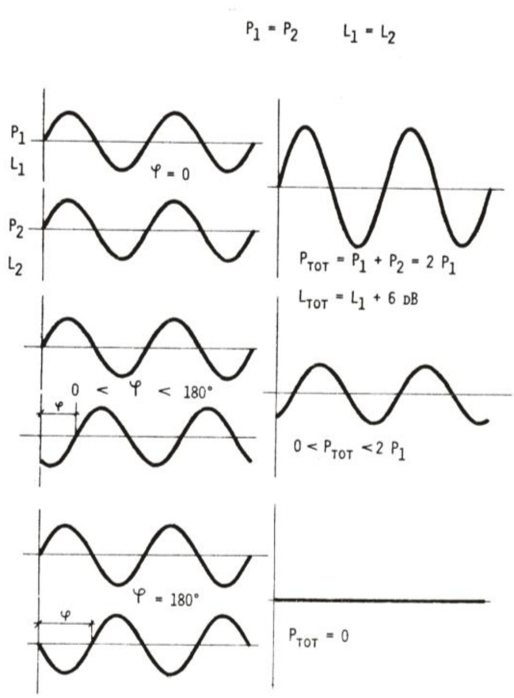

Figure 6: *Illustrative examples of summing of two coherent waves*

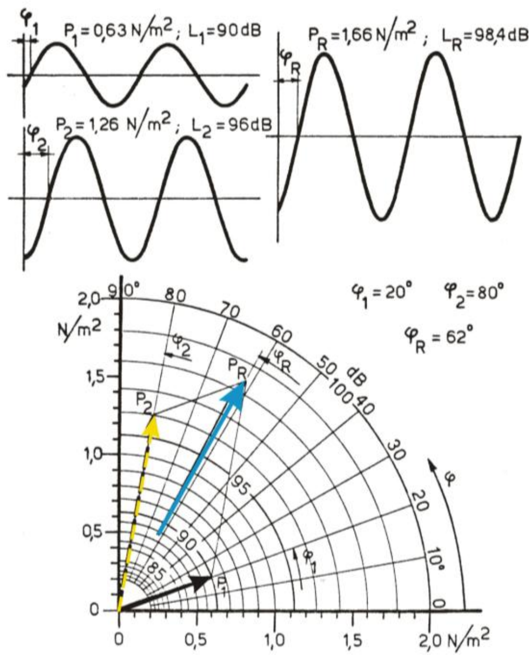

Figure 7: *Phasor diagram of summing two coherent sources*

In the case of a constant amplitude, but phase difference changing from 0 to 180^0, the resulting amplitude changes from 0 to 2. When the phase difference between two sources is 180^0, in terms of theory, the level, that is to say, amplitude is equal to zero point. This conclusion is applied in active noise reduction [5].

Figure 7 shows the way of phasor summation of two sources with different amplitude and phase.

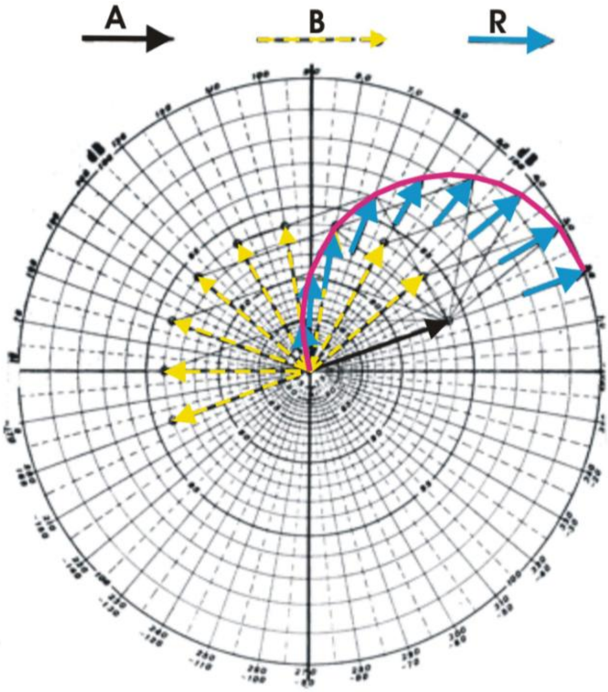

Figure 8: *Summing two coherent sources of variable phases*

The first coherent source level is $L_1 = 90$ dB, the second coherent source level is L_2 =96 dB, and acoustic pressures are given as formulae, (4 and 5):

$$p_1 = 0{,}63\sin\left(\omega t - 20^0\right), \text{ N/m}^2 \tag{4}$$

$$p_2 = 1{,}26\sin\left(\omega t - 80^0\right), \text{ N/m}^2 \tag{5}$$

The resulting level will be $L_R = 98{,}4$ dB, and its current value is given as formula (6):

$$p_R = 1{,}66\sin\left(\omega t - 62^0\right), \text{ N/m}^2 \tag{6}$$

By using a phasor diagram in the Figure 7, it is easy to sum two or more coherent signals.

An illustrative example of summing two identical noise levels of coherent signals is shown in the Figure 8, where the mutual phase is changed from 0 to 180^0. The resulting amplitude is found in the range from the double amplitude value to zero.

A typical example of summing three coherent sources is given in the Figure 9 as following $\vec{A} = 98$ dB, $\vec{B} = 92$ dB and $\vec{C} = 86$ dB. Figure 9 shows graphic summing of phasors by application of circle diagram.

$$\vec{R}_0 = \vec{A} + \vec{B} + \vec{C} \tag{7}$$

Total sum $\vec{R}_0 = 93$ dB.

If one of the coherent sources, e.g. *A*, were modified so that its amplitude and phase were changed, and its level were $\vec{A} = 94$ dB, then the total sum would be $\vec{R}_0 = 84$ dB, that is to say, reduced for 9 dB.

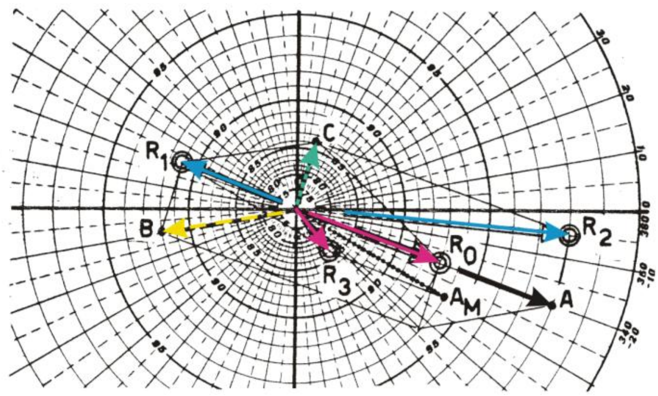

Figure 9: *Example of summing three coherent sources*

The arranged overview of the results of the previous analysis is given in the Table 3.

Table 3: *Results of summation of three coherent sources*

	A	*B*	*C*	R_0	ΔL
Level, dB	98	92	86	93	-
Insulation L_A	94	92	86	84	9

By using coherent controlled noise source one can do an active control and reduction of sound source. The source being controlled has an integrated device measuring the amplitude and phase of the coherent, undesirable source. Based on the measurements, the controlled source produces the sound of the same amplitude, but the opposite phase, and in that way it reduces the total level of noise.

CONCLUSIONS

In the case of summing several noncoherent sources, it is extremely important to analyse their level before applying insulation. If they are of the same or nearly the same level, the reduction, the insulation of each source is fully technically justified. If there are several sources of various levels, the insulation of the highest level source gives individually the most remarkable effects. The highest reduction is achieved by insulating all the sources.

As for coherent sources, besides the source level, the phase is of extreme relevance. By changing the phase between two or more signals, considerable results could be obtained, even without reduction of the source levels. This is commonly used with the active noise reduction.

ACKNOWLEDGMENTS

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[1] R&D TRACTORS FROM ASPECTS OF ERGONOMY AND DESIGN

Svetlana Vukas, Velimir Petrović, *IMR Institute, Belgrade, Serbia*

UDC: 629.114.2:331.101.1
631.372-11

Abstract

Research is done with goal to define ways of development and going with latest trends in domestic tractor manufacturer developments. Average mileage of agriculture mechanization in our country was 20. to 25. years in two last years. Today, thankfully to certain stimulation and benefits from Serbian Government average mileage is from 15. to 20. years of age. However our country has manufactures of tractors and agriculture mechanization with long term experience and tendency in development, its own goal is to increase level of research and development in all organisations, which will lead to gaining higher technical and technology level. Course of research in world in last 10-15. years, are drifting to development of tractors which include ecological, safety, economical, efficiency and influence of tractor manufacturer in better expense towards to customers. The results of this research are modern products and according to that new standards and directive which tractor manufactures must be accomplish. Aim of paperwork is to show the most important fields and directions in research and tractor development as ergonomics and design. Beside that it will be given elemental view in conditions in this field in our country and possible directions of developments.

Key words: tractor, design, ergonomics.

ISTRAŽIVANJE I RAZVOJ TRAKTORA SA ASPEKTA ERGONOMIJE I DIZAJNA

UDC: 629.114.2:331.101.1
631.372-11

Rezime: Istraživanje je rađeno sa ciljem da se definišu pravci razvoja i osavremenjavanja traktora domaće proizvodnje. Prosečna starost poljoprivredne mehanizacije u našoj zemlji do pre dve godine kretala se izmedju 20 i 25 god. starosti. Danas se zahvaljujući određenim podsticajima i olakšicama vlade ona nešto poboljšala i kreće se izmedju 15 i 20 god. Obzirom da naša zemlja ima proizvođače traktora i poljoprivredne mehanizacije sa dugogodišnjom tradicijom razvoja i proizvodnje, potrebno je i podići nivo istraživanja i razvoja u ovim organizacijama, čime bi se i proizvodi ovih organizacija podigli na viši tehnički i tehnološki nivo. Pravci istraživanja u svetu zadnjih 10-15 god. kreću se ka razvoju traktora koji uključuju očuvanje čovekove okoline, bezbednost, ekonomičnost,

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efikasnost i uticaj traktora kao proizvoda na korisnika-operatera. Rezultati tih istraživanja su savremeni proizvodi i novi standardi i direktive koje proizvođači tarktora moraju da zadovolje. Cilj rada je da prikaže najznačajnije oblasti i pravce u kojima se rade istraživanja i razvoja traktora kao što su ergonomija i dizajn. Osim toga biće dat osvrt na stanje u ovoj oblasti u našoj zemlji i pravci mogućeg razvoja.

Ključne reči: traktor, dizajn, ergonomija.

R&D TRACTORS FROM ASPECTS OF ERGONOMY AND DESIGN

Svetlana Vukas [1]***, Velimir Petrović***

UDC: 629.114.2:331.101.1
631.372-11

INTRODUCTION

In the development of modern tractors, ergonomics quality is one of crucial criterions for upgrade of new developing products. Basic principal of ergonomic quality in tractor manufacturing can been described in multiple criterions, which the most important are:

- Driver safety
- Easy access to driver seat
- Conformity of driver seat
- Availability of tractor handling
- Visibility
- Tractor handling
- Working ambient of driver

All of these criterions have certain influence on tractor driver, on efficiency of tractor usage and productivity level which is essential from driver safety, his pleasure in working ambient, level of tractor efficiency and comfort. These criterions are issued in various standards, EU directives and legislations with obligatory purpose for every tractor manufacturers or industry. On various examples are given detail analysis of driver seat designs from aspect of design, ergonomic and new approach in tractor development. [1]

CONFROMITY OF TRACTOR SEAT

System for driver seat with static and dynamic characteristics is influenced on all kind conformity and compatibly of driver place in tractor. If we looked on driver seat basically we can conclude that on seat are influenced static and dynamic forces which are transferring from tractor to driver seat. Uncomfortable seat is cause of fatigue, back pain and generally speaking uneasy feeling during driving. Research in this field are showed that there are two scenarios: driver seating place is spot where driver body is in the contact with seat and feeling is soft, and opposite when driver seat is relatively firm; so conclusion is that the driver seat is contact surface where are tractor transferring forces in between seat and tractor driver. Dynamics pressure on contact surface had near sinus value with vibrations values between 1-10 Hz. Under this influent circumstances max values of dynamic pressure, under appearance of resonance, is on the contact surface is 4.5-5 Hz. The stress factor occurred upon driver during vibration is transferred on human body and the shock on organism is recognized as back pain.

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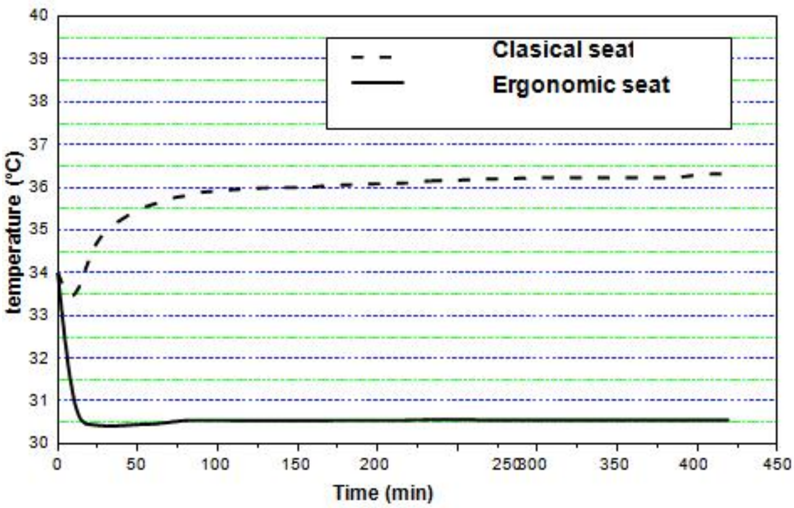
[1] Corresponding author e-mail: imr-institut@eunet.rs , *IMR Institute, Patrijarha Dimitrija 7-13, Belgrade, Serbia*

For long time it was assumed that conformity is vehicle characteristics, with its value is in the range of max conformity to max disconformities. Old definition was `` Feeling of easiness and joy during driving`` witch had only technical character. More scientific approach had next definition`` balance of psychic, psycho- physical and psychological condition of men who is in harmony with its environments``. This means that conformity is lack of disconformities. However lots of research showed that conformity is close to latest definition as`` relationship between psychological and psycho- physical factors witch could affect on driver``.

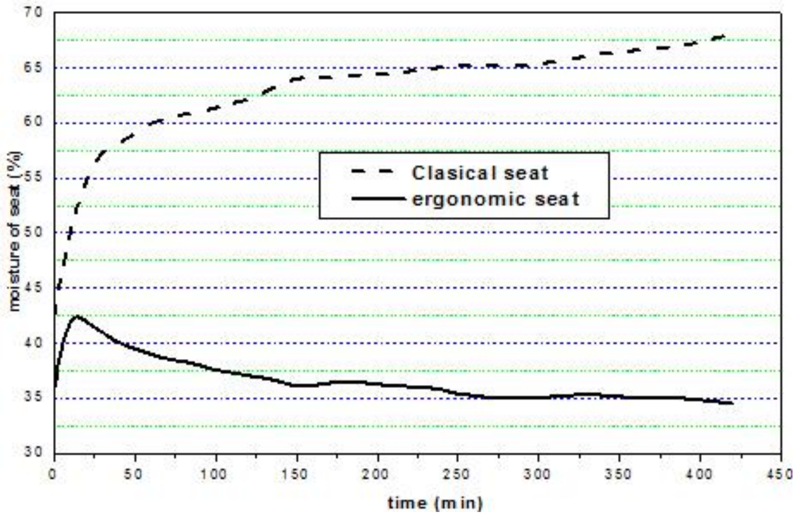
Beside driver position, vibration, shape and feeling of seat firmness that could influenced on seat disconformities, also it could be important temperature of seat and its moisture. The class of conformity during seating could be determined by mechanical methods, and methods which include temperature and moisture measuring on contact surface between driver and seat; and additionally on following psycho-physical condition of driver and etc.[2]
Most familiar methods for determining discomfort are based on next standards:

- ISO 2631 and BS 6841 with are defining magnitude of discomfort by value of vibration level,
- ISO 3386/1 method for determine level of pressure on seat by pressing plate ring,
- ISO SD 5982 method with determining mechanical influence on driver seat until the driver head and transferring vibration through all body,
- ISO 4253 which define optimal dimensions based on body column position.



1.a

Results of research are evaluated by developing research on ergonomic aspects and design, and that are new methods for research the ratio of demands based on conformity. As example it could be derived method for some ergonomics researching for testing influence changes of temperature am moisture human body changes by German manufacturer GRAMMER AG Seating Systems as DLG Test. On the figure 1., are presented influences of temperature and moisture in seat of tractor driver.



1.b

Figure 1: *Graph of changes in temperature and moisture of driver body in dependence of length of working time [2]*

In the figure 2., is presented classical seat and seat designed by considering new ergonomic characteristic. It has to said that Standards, Legislations and EU Directives that are issued by approval type procedure project both seats.

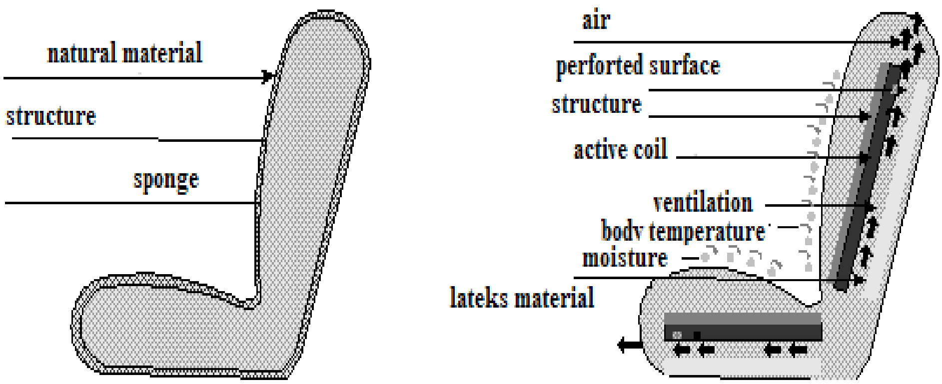


Figure 2: *Schematic of classical seat and seat were are included ergonomic characteristics as body temperature and moisture [2]*

New approach in designing product from aspect of ergonomics, and by developed new technologies which where used to reduce discomfort. As example is given figure 3 where is presented ``intelligent seat`` with its functions.

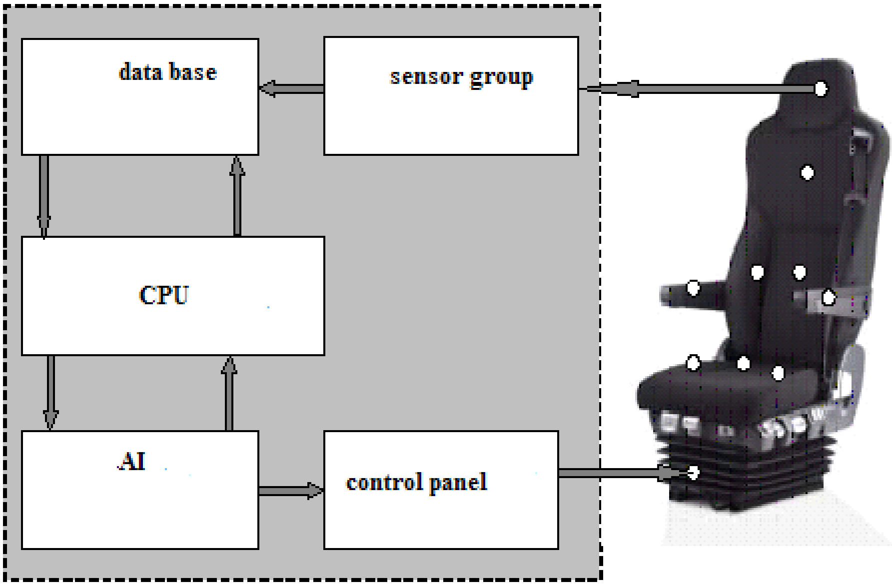


Figure 3: *Intelligent seat[2]*

Intelligent system is introduced by upgrading comfort of driver seat. Seat is equipped with numerous sensors, and with detection of body position. Sensors data is loaded in data base which are transferred in CPU for data processing. When the data is processed they are transferred in artificial intelligence for further data processing. Then, data which were processed are sent in control panel followed by most appropriate position of seat for driver.

AN EXAMPLE OF DEVELOPING NEW METHODS OF TESTING WHICH INCLUDE COMPLEX APPROACH IN DESINGING NEW TRACTORS

Leading tractor manufactures, as John Deere has developing methods which accomplish ergonomic conditions of seat. Following that conditions manufacturer has developed method for analysis and testing conformity of tractor cabin. Method is based on software model named ERGONAUT, which can simulate multiple driver virtual environments by combining data from driver real and virtual environment. For purposes of testing and research it is possible to:

- Adjusting position of virtual tractor driver by Virtual-Anhtropos which is designed for this method and which has unlimited posibilities of adjusting the position of driver body position.
- following real driver in simulation (virtual) cabin of tractor by simulator of tractor drivability

- following virtual driver in virtual tractor cabin
- following real driver in real tractor cabin[2]

This kind in approach of analysis and testing allowed detecting remarks of ergonomics in early phase designing of tractor cabin. The tractor design in this kind modeling has increasing impact of designing in all; for example designing Studios are not modeling one part of chassis but it has been stilled vehicle chassis as whole tractor. Designing of tractor by new principles include aspect of ergonomic and new design, thus has specific approach and must answer to different specific demands. By that it is considered whole shape of tractor must follow harmony accomplish in design, by following technical demands in basic tractor usage. Designers approach must implement ergonomic demands by improving imaginary tractor line and not to disturb functionality and safety demands which are standard for tractor as a product. Such importance in following ergonomics demands can be seen in LANDINI`S studies which are obvious in Figure 5.

Figure 4: *First Tractor*

Figure 5: *New Design Tractor Generations[3]*

Figure 6: *Studio's concept of tractor design in new direction of ergonomics concepts with aerodynamic shape of vehicle [3]*

In field of agriculture machines and mostly tractors new approach in design and ergonomics, is mostly present and it could be saw in few latest years. Interesting futuristic design, it can be Landini design, which studio is crucial in car design, with aerodynamic shape chassis.

DEVELOPINIG LEVEL OF TRACTORS IN WORLD AND IN OUR COUNTRY FROM ASPECTS IN IMPLEMETATION OF NEW PRICIPLES IN ERGONOMICS AND DESIGN

Almost all tractor manufacturers in word had accepted principles of ergonomics approach in tractor production. As right illustration could be used example in Table 1. For this purpose are given ergonomics demands as main characteristics in tractor industry.

Table 1. *Over look of main ergonomic characteristics* [5]

Ergonomics characteristics Level of implementation of ergonomics demands in small and medium tractors: ●- full accomplished ◐- semi accomplished ○- accomplished in small amount ⊗- not accomplished	Manufacturer													
	John Deere	LANDINI	SAME	New Holland	Mercedes-Benz	Massey Ferguson	LOMBORGHINI	Renault	CASE	HORSH	DEUTZ	URSUS	Zetor	Belarus
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Safety of tractors driver														
- protected structure with one frame	●	●	●	●	●	●	●	●	●	●	●	◐	◐	◐
- protected structure with two frames	●	●	●	●	●	●	●	●	●	●	●	●	●	●
- cabin	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐
Easy access to drivers seat														
- seat between back seats	◐	◐	●	●	◐	●	●	●	●	●	●	●	●	●
- seat between shafts	○	○	⊗	○	○	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗
- ergonomics rise	●	●	●	●	●	●	●	●	●	●	●	●	●	●
- ergonomics handlers	●	●	●	●	●	●	●	●	●	●	●	◐	◐	◐
- size of entry doors-optimal	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Comfort of driver seat														
- seat of depreciation;	●	●	●	●	●	●	●	●	●	●	●	●	●	●
- moving backward -forward	●	●	●	●	●	●	●	●	●	●	●	●	●	●
- adjusting of stop lug	●	●	●	●	●	●	●	●	●	●	●	◐	◐	◐
- anti allergic and anti static material	●	●	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐
- automatic adjusting of seat micro air condition	○	○	⊗	○	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗

Ergonomics characteristics Level of implementation of ergonomics demands in small and medium tractors: ●- full accomplished ◐- semi accomplished ○- accomplished in small amount ⊗- not accomplished	Manufacturer													
	John Deere	LANDINI	SAME	New Holland	Mercedes-Benz	Massey Ferguson	LOMBORGHINI	Renault	CASE	HORSH	DEUTZ	URSUS	Zetor	Belarus
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Tractor drivability														
- mechanical steering	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	○	○	○
- electro- hydraulic steering	●	●	●	●	●	●	●	●	●	●	●	◐	◐	◐
- clearance	●	●	●	●	●	●	●	◐	●	◐	●	◐	◐	◐
Visibility														
- glass surface	●	●	●	●	●	●	●	●	●	●	●	●	●	●
- nose down	●	●	●	●	●	●	●	●	●	●	●	◐	◐	◐
- working space	●	●	●	●	●	◐	●	●	●	◐	◐	◐	◐	◐
- instruments and commands	●	●	●	●	●	●	●	●	●	●	●	◐	◐	◐
- exhaust muffler position	●	●	●	●	●	●	●	●	●	●	●	●	●	●
- adjusting of steering	●	●	●	●	●	●	●	●	●	●	●	●	●	●
- night lights	●	●	●	●	●	●	●	●	●	●	●	●	●	●
- cabin lights	●	●	●	●	●	●	●	●	●	●	●	●	●	●
- visibility of instrument table	●	●	●	●	●	●	●	●	●	●	●	◐	◐	◐
Tractor handling														
- automatic blockade of front differential	●	●	●	●	●	●	●	●	●	●	●	◐	◐	◐
- automatic blockade of gear differential	●	●	●	●	●	●	●	●	●	●	●	◐	◐	◐
- semi Powershift	●	●	○	●	●	○	○	○	○	○	○	⊗	⊗	⊗
- fully Power shift	○	○	○	○	○	○	⊗	⊗	⊗	○	⊗	⊗	⊗	⊗
- semiautomatic gear	◐	◐	◐	◐	◐	○	○	○	○	○	○	○	○	○
- automatically continual gear	◐	◐	○	◐	◐	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗
Working ambient														
- cabin noise optimal	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	○	○	○
- natural condition of air	●	●	●	●	●	●	●	●	●	●	●	◐	◐	◐
- air condition	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	◐	○	○	○
- radio	◐	◐	○	◐	◐	○	○	○	○	○	○	⊗	⊗	⊗

Conditions in our industry are transferring to our domestic tractor manufactures and developing tempo of new products. In implementations of new approach in developing it can be noticed continual obsolete and decreasing in implementation of new ergonomic issues in products.

Tabel 2. *Implementation of ergonomic demands in domestic tractors* [5]

Ergonomic Characteristic	**Manufacturers**	
Level of implementation of ergonomics demands in small and medium tractors: ●- full accomplished ◐- semi accomplished ○- accomplished in small amount ⊗- not accomplished	**IMR**	**IMT**
1	**2**	**3**
Safety of tractors driver		
- protected structure with one frame	◐	◐
- protected structure with two frames	◐	◐
- cabin	◐	◐
Easy access to drivers seat		
- seat between back seats	●	●
- seat between shafts in the middle	⊗	⊗
- ergonomics rise	●	●
- ergonomics handlers	◐	◐
- size of entry doors-optimal	●	○
Comfort of driver seat		
- seat of depreciation	◐	◐
- moving backward -forward	●	●
- adjusting of stop lug	○	○
- anti allergic and anti static material	⊗	⊗
- automatic adjusting of seat micro air condition		
Tractor drivability	⊗	⊗
- mechanical steering	⊗	⊗
- electro- hydraulic steering	●	●
- clearance	●	●
Visibility	●	●
- glass surface	●	●
- nose down	◐	◐
- working space	●	⊗

Ergonomic Characteristic	Manufacturers	
Level of implementation of ergonomics demands in small and medium tractors: ●- full accomplished ◐- semi accomplished ○- accomplished in small amount - ⊗- not accomplished	**IMR**	**IMT**
1	**2**	**3**
- instruments and commands	●	⊗
- exhaust muffler position	●	●
- adjusting of steering	◐	◐
- night lights	◐	◐
- cabin lights	●	●
- visibility of instrument table	◐	◐
Tractor handling		
- automatic blockade of front differential	⊗	⊗
- automatic blockade of gear differential	⊗	⊗
- semi Powershift	⊗	⊗
- fully Power shift	⊗	⊗
- semiautomatic gear	⊗	⊗
- automatically continual gear	⊗	⊗
Working ambient		
- cabin noise optimal	⊗	⊗
- natural condition of flow air	●	●
- air condition	◐	◐

CONCLUSION

World manufacturers in tractor industry are intensively working in upgrading its products by implementing ergonomic designs that was result of intensively meeting standards in tractor industry. Beside various safety category and ergonomic criteria, they also had to meet new design in modeling tractors chassis. However, having in mind, they were used experiences from car industry also. In our industry, we have very large space in upgrading tractor ergonomics and chassis design and keep our knowledge with latest in research and developing in tractor manufacturing.

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[1] EMISSIONS CHARACTERISTICS OF TRACTORS DIESEL ENGINE FUELLED WITH THE BLENDS OF MINERAL DIESEL-BIODIESEL FUELS

Radinko Gligorijević, Jeremija Jevtić, Đuro Borak, *IMR-Institute, Belgrade, Serbia*

UDC: 662.756.3:621.43.068]:504.3.054

Abstract

The growth in the number of vehicles worldwide has led to increase fuel consumptions, and air pollution and CO_2 emission. It is fact that millions of dollars are currently being channeled in the direction to find ways to reduce CO_2 emissions, instead of to reduce the harmful PM and NOx emissions.

Currently practically 97% of transportation fuels are produced from crude oil.

The growing fuel consumption can not be covered only by conventional and limited fossil sources. Alternative fuels offer the potential to stretch the resources of conventional fossil fuels. These fuels are free of sulfur and aromatics, they have high cetane numbers and they offer advantages for engine emissions.

From this aspect paper deal with the influence of fuel blends mineral diesel – biodiesel on diesel exhaust emissions.

Key words: biodiesel, emissions, diesel engine.

KARAKTERISTIKE EMISIJE TRAKTORSKIH DIZEL MOTORA KOJI KAO GORIVO KORISTE MEŠAVINE MINERALNIH BIO-DIZEL GORIVA

UDC: 662.756.3:621.43.068]:504.3.054

Rezime: Stalni rast broja vozila širom sveta doveo je do povećanja potrošnje goriva, povećanja emisije CO_2 i zagađenja vazduha. Činjenica je da se danas troše milioni dolara za iznalaženje puteva za smanjenje emisije CO_2, umesto na smanjenje štetnih emisija NOx i PM. Danas se praktično 97% goriva za transport proizvodi iz sirove nafte.

Rastuća potrošnja goriva ne može biti pokrivena samo iz ograničenih konvencionalnih fosilnih izvora. Alternativna goriva nude mogućnost produženja resursa konvencionalnih fosilnih goriva. Ova goriva su bez sumpora i policikličnih aromata, ona imaju visoke vrednosti cetanskog broja a u motorima daju izduvne emisije sa manje štetnih gasova.

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Accepted: December 2010. Prihvaćen: decembar, 2010.god.

Sa tog aspekta rad se bavi uticajem mešavine mineralnog dizela sa biodizelom na emisije izduvnih gasova traktorskog dizel motora.

Ključne reči: biodizel, emisije, dizel motor.

EMISSIONS CHARACTERISTICS OF TRACTORS DIESEL ENGINE FUELLED WITH THE BLENDS OF MINERAL DIESEL-BIODIESEL FUELS

Radinko Gligorijević [1], Jeremija Jevtić, Đuro Borak

UDC: 662.756.3:621.43.068]:504.3.054

1. INTRODUCTION

Reduction polutant emissions, esspecially NOx and PM, and CO_2 emissiona has now a major driver for changes in automotive technology. It is fact that millions of dollars are currently being channeled in the direction to find ways to reduce CO_2 emissions, instead of to reduce the harmful PM and NOx emissions.

NOx emissions affect respiration, with the main component being NO_2 , whitch it is heavy gas and not easily dispersed in the atmosphere. It means that people with existing health conditions are more vulnerable to futher complications.

As for as particle matter emission the bigest problem is the size of it – below a sertain mass we can ingest the particlees into our lungs [1]. In essence, the lungs have a natural filtration sistem that keeps out the big lumps of carbon and soot quite well, but as the particles get smaller, they can be ingested and this cause problems for people who have respiratory and heart conditions. Some particle is fairlu inert, but it can carry absorbed on to it, soluble organic fractions that are carcogenic. Partcles that cause cancer are in the order of 2,5 μm in size. It means that there will be futher PM and NOx reductions levels (beyond thase in Euro 6 propols) –but in much smaller steps. There is likely to be a seperate NO_2 limit, as this is a particularly harmful gas.

Therefore, what is needed from automotive legislations is a comon sence approuch to, first, create more-efficient vehicles, with a fiew not to reduce CO_2 emissions but to avoid unnesessery waste and thus prolong earth`s resources, and second, for legislators to focus on emissions tha are actually toxic, as in demaging to one`s health.

It should to say that in nowday, as in the past two decades the focus of world public debates is about climate change caused by human activities implied, with emphasis on road transport. Even though there is no scientific foundation for the implied and imposed on the public and keep repeating the claim that human activity caused the increase of CO_2 content, which can lead to catastrophic consequences on the eco-systems, all EU countries have adopted climate change as a major task in environmental protection. The main pillar of activity is trans-national Commission on Climate Change (IPCC), that the hypothesis of climatic changes in the last 100 years based on three indicators of potential greenhouse gas: CO_2, CH_4 and N_2O. Surprising that the potential of water vapor does not take into account,

[1] Corresponding author e-mail: imrkb@eunet.rs, IMR-Institute, P. Dimitrija 7, 11090 Belgrade, Serbia

although it seems (60) -95% of greenhouse gases effect. CO_2 from human active times is only 3% of the natural flux (Fig. 1), and it, together with oxygen in the Earth's biosphere to participate in the metabolism of the planet depending on its absorption.

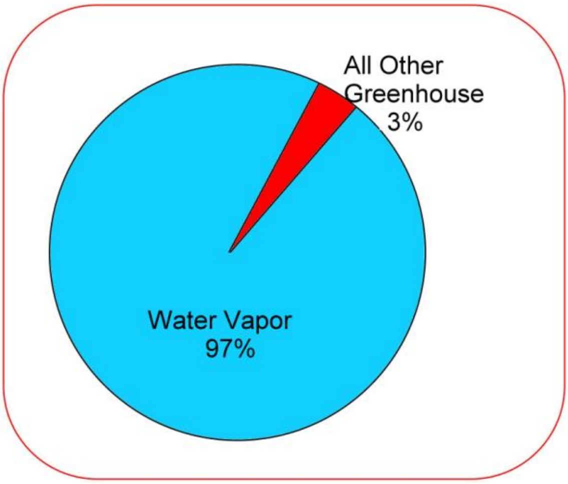

Figure 1: *Composition of greenhouse gas [2]*

It has been shown to increase from 200-1000 ppm CO_2 is beneficial for the growth of plants, particularly cereals and their use of water. This means that this level of CO_2 and higher, can not have adverse environmental effects. According to the opinion of the European Parliament's transport sector is a major emitter of carbon dioxide. Hence, this sector should be the starting point in preventing climate change. So the pressure is on the automotive industry, primarily to producers of passenger cars to reduce CO_2 emissions. Therefore the entire world road traffic (passenger and freight) contribute about 12% of global anthropogenic CO_2 emission and about 0.5% CH_4 emission [3].

Do you have launched and continuously spreading news about the catastrophic dangers of climate change due to global warming, as a consequence of human activities facts, possible facts, or fabrication depends on who chooses what to believe. In a campaign designed to market and political studies are included in all media, eco-lobbyists, politicians (eg.Tony Blair, Al Gore), many scientific institutions, the so-called independent intellectuals and scholars, who in their own interests causing major damage but not only science but and social progress in general, and the IPCC, as an advisory body of the United Nations, which is the main pillar of activity in the prevention of these conceived and launched catastrophic consequences of global warming as a consequence of anthropogenic activities increase in CO_2 emissions [4,5].

Hypotheses about the disastrous spread of risk by alarmism have no scientific basis, and are identical to intimidation of the people of pandemic influenza, which creates a powerful pharmacy industry and lobbyists.

The actual impact on the anthropogenic greenhouse effect is very small (~ 1%, Fig. 2).

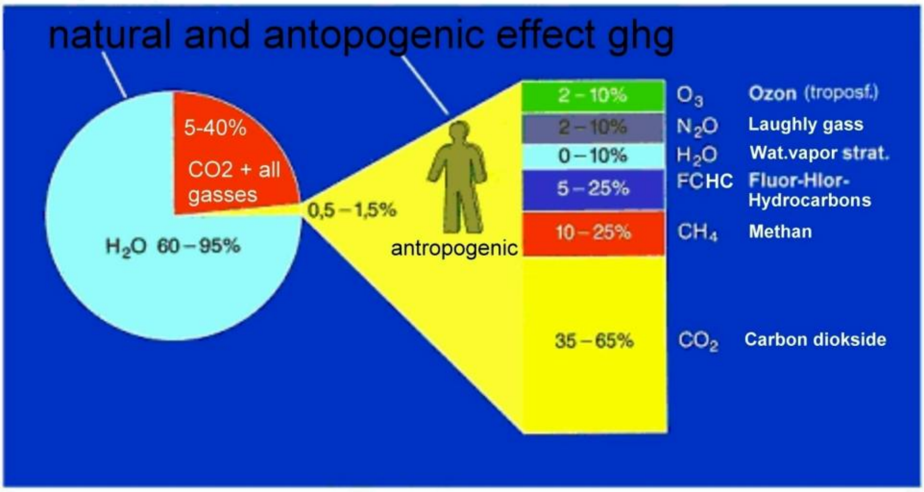

Figure 2: *Influence of natural and anthropogenic emissions of greenhouse structure [6]*

Constant improvement of technology achieved a significant reduction of greenhouse gases in the exhaust emission cars, so that today a modern car that meets the EU-4 emission norms emits hydrocarbons, but 300 cars 40 years ago.

Claims that the car is responsible for climate change due to CO_2 emissions are unfounded, and political demands that reduction automotive CO_2 emissions, there is justification only from aspects fuel consumption i.e. rational primary energy consumption, since CO_2 emissions is directly proportional to fuel consumption. This means that the emission cars of 120g CO_2 / 100km, as prescribed by 2012., it will be appropriate fuel consumption of 4.5 to 5.0 l/100km.

It is clearly not only now in the era of the global financial crisis but also in the future, there will be no more cheap energy. The global energy crisis can be resolved only by a wave of innovation in all industries, especially in the automotive industry, which is the driving force of economy in developed countries. Innovation economy can only improve all aspects of human life, and new innovations can arise only as a result of scientific-research laboratories and scientists who are not in the service of politics and business lobbies, such as causing the most damage science and general social progress. Of course we needed a new much more honest and daring leaders, both in industry and in politics, who will be more respected scientific truth, but business lobby dictates, why in recent years eaten "living tissue" of the economy and created economic crisis.

Increase the number of vehicles in the world leads to a global increase in energy consumption (Fig. 3). The transport sector consumes about 30% of primary energy, and about 97% of transport fuels produced from oil.

In the coming period, the main guideline in the development of new automotive technologies are: 1) energy efficiency, 2) efficiency and reliability and 3) ecology. For realizing this big 'E' trilemme transport sector needs to develop a) vehicle improved energy efficiency, b) alternative fuels and low emision engine oil [7], c) low-emission vehicles and low weight, d) intelligent transportation systems.

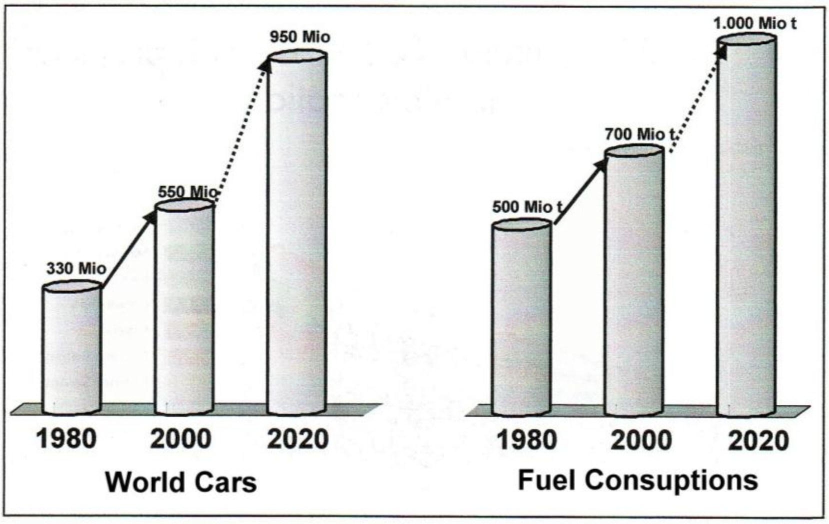

Figure 3: *Future the growth of car and fuel*

Alternative fuels are an opportunity for people to leave oil before it leaves them, i.e. to slow down the exploitation of mineral resources and slow down the forecasted end of the announcement, and to reduce emissions.

Alternative fuels, particularly from lignoceluloze i.e. II generation biofuels are a great opportunity for the world economy and a great opportunity to increase the employment[8,9].

2. EXPERIMENTAL

Tests of the effect of biodiesel and mineral diesel mixture on diesel exhaust emissions have been performed on a three cylinder tractors DI diesel engine (THDM 33/T~ TD 3.152 Perkins) of rated power 40.5 kW, 2250 R.P.M. swept volume 2.5 dm^3 , turbocharged KKK 14 with intercooler. The engine is an older design with an open combustion chamber in the piston, while nozzles have 4 holes with dia.0.28 mm each. Injection pressure is 210 bar and injection angle 12^0 . It is well known that the majority of investigations relating to the effect of fuel quality on diesel emissions are performed on engines of modern design that having considerably higher injection pressures and that have nozzles with greater number of holes.

Three types of diesel fuel have been used in this study: 1) regular diesel fuel (according En 590: ρ=0.84g/cm^3,S=0.035%, CI=48.6, aromatics=26%) as a reference (B0), 2) 20% (B20%) and a 3) 30% (B30%) v/v blend of rape seed biodiesel-RME (according En 14214: ρ=0.88g/cm^3, CI=53) and regular diesel and biodiesel fuel (B20%: ρ=0.84g/cm^3, CI= 49.5), B30: ρ =0.86g/cm^3, CI= 51.5).

It is observed that density of biodiesel –B20 and B30 is higher, while the mass-based energy content is lower (8.5%) then those of mineral diesel. Also, it is observed that density of biodiesel - B30 exceeded (0.86g/cm^3) the specification limit of EN 590 for mineral diesel.

Diesel engine emissions were measured in accordance with ECE R96 Regulation, 8-mode cycle.

3. RESULTS AND DISCUSION

The value of specific emissions NOx and PM (g/kWh) for three types of diesel fuel are shown in Figure 4. They are the result of making an average value of an emission for each mode and basic parameters of engine functional characteristics.

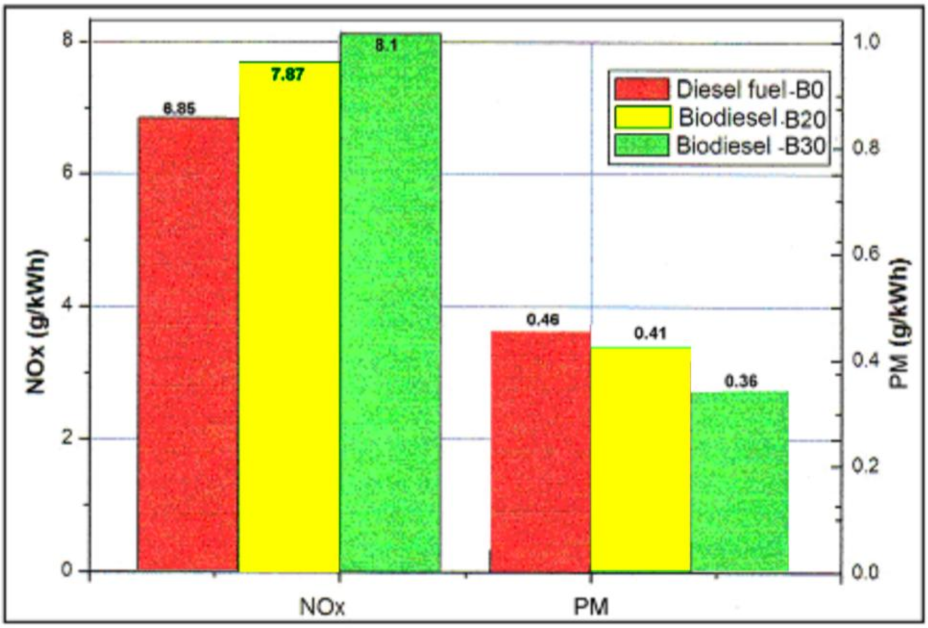

***Figure 4:** Specific PM and NOx emissions of diesel fuels-B0 and blend-B20 and B30 biodiesel fuels*

It can be seen from Figure 4, that PM emission level of B20 and B30 fuel is decreased by 11% and 21% respectively, in relation to the reference regular diesel fuel, whereas NOx emission level is increased by 15-18% respectively, in relation to the reference regular diesel fuel. It is unknown exact cause of the increased NOx emissions for biodiesel. However, a number of fuel properties - as cetane number, density, heating value and iodine number, as well as operating conditions have influence on NOx emissions [10]. The higher oxygen availability in the combustion chamber could promote higher NOx emissions. NOx emission level of B30 fuel is higher by 3% in relation to the blend B20. The fuel formulation, which results in oxygen being embedded in the fuel, could result in increased flame temperature in the premixed burning region. Also, it can increase heat release in the premixed burning phase. It means that these factors lead to an increase in NO and NOx levels.

As far as PM emission, there are several factors that contribute in the reduction of its. The oxygen content of the biodiesel molecule, the absence of aromatics, the lack of sulfur, and the lower final boiling point of biodiesel are the main factors that govern PM formation. PM emission level of B30 fuel is lower about 12% in relation to the blend B20.

Fuel consumption was increased about 3, 5- 4.3% with respect to mineral diesel fuel due to the shortfall in energy content of B20 and B30. Also, it was observed 1, 5-2.5% loss of power output with the application of biodiesel-B20 and B30.

The engine thermal efficiencies were increased for B30 blend fuel. The addition amount of biodiesel to low-sulfur mineral diesel improved blend lubricity which would reduce frictional losses. On the other hand biodiesel contains as much as 10% oxygen, and the presence extra oxygen, particularly in the high loads, may help to improve the overall combustion process and improve thermal efficiency.

4. CONCLUSIONS

The following conclusion may be drowning as a result of this study:

1. Studiously designed and launched the news, with the news media constantly repeated on the catastrophic dangers of climate change due to global warming, as a consequence of human activities in increasing concentrations of CO_2, are unfounded and with out scientific evidence.

2. Claims that the car is responsible for climate change due to CO_2 emissions are unfounded, and political demands to reduce automotive CO_2 emissions, there is justification only from aspect fuel consumption i.e. rational primary energy consumption, since CO_2 emissions is directly proportional to fuel consumption.

3. The density and cetane index of mineral diesel –biodiesel blends is increased compared to the density of the mineral diesel fuel, due to the higher density of the biodiesel fuel.

4. PM emission level of B20 and B30 fuel is decreased by 11% and 21%, respectively, in relation to the reference regular diesel fuel.

5. NOx emission level of B20 and B30 fuel is increased by 15-18%, respectively, in relation to the reference regular diesel fuel.

6. Using blends of biodiesel and mineral diesel can reduce consumption mineral diesel and therefore reduce the dependence on mineral oil imports, and reduction of energetic dependence.

7. Alternative fuels, particularly from lignocelluloses i.e. II generation biofuels are a great opportunity for the world economy and a great chance to increase employment, reduce the consumption of mineral fuels and reduce greenhouse gas emissions.

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MVM *Editorial Board*
University of Kragujevac
Faculty of Mechanical Engineering
Sestre Janjić 6, 34000 Kragujevac, Serbia
Tel.: +381/34/335990; Tel.: 336002; Fax: + 381/34/333192
www.mvm.mfkg.kg.ac.rs