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ELECTRIC KARTING – FROM AN IDEA TO THE REALISATION

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RESEARCH ARTICLE

ABSTRACT: It is certain that the first steps of the vehicle drives each individual person were made in karting vehicle. Additional adrenaline and increase driving pleasure gives extremely high noise and the smell of combustion products that may still endure when the ride takes place on an open track during sunny days. However, for many years karting rides take place indoors where it is necessary to provide a special ventilation system for undesirable combustion products. In order to avoid problems of air pollution indoors, reduce noise, and raise awareness of young generations in terms of preservation of the environment, today is increasingly use of electric karting. Having in mind the multiple benefits of electric drive, a reconstruction of karting vehicle with petrol engine into electric karting is presented in the paper. A special attention was paid to the selection of the electric powertrain and battery storage units for electricity, as well as dynamic characteristics of the reconstructed electric vehicle.

KEY WORDS: electric karting, ecology

ELEKTRIČNI KARTING – OD IDEJE DO REALIZACIJE

REZIME: Sigurno je da su prvi koraci vožnje vozila svake osobe zasebno napravljene u karting vozilu. Dodatni andrenalin i povećanje zadovoljstva u vožnji daje izuzetno veliku buku i mirise procesa sagorevanja koji ostaju kada se vožnja odvija na otvorenoj stazi tokom sunčevih dana. Međutim, već dugi niz godina karting vožnja se odvija u zatvorenom prostoru gde je neophodno obezbediti poseban ventilacioni sistem za nepoželjne produkte sagorevanja. Da bi se izbegli problemi zagađenja vazduha u zatvorenom, smanjila buka i podigla svest mladih generacija u smislu očuvanja životne sredine, danas se sve više koristi električni karting. Imajuci u vidu višestruke prednosti električnog pogona, u radu je prikazana rekonstrukcija karting vozila sa benzijskim motorom u električni karting. Posebna pažnja je posvećena odabiru električnog pogona i akumulatorske jedinice za električnu energiju, kao i dinamičkoj karakteristici rekonstruisanog električnog vozila.

KLJUČNE REČI: elektirčni karting, ekologija

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1. INTRODUCTION

The first steps that every young person made in the drive of a motor vehicle are related with karting which is usually powered by the petrol engine. In order to achieve relatively good dynamic characteristics in forms of acceleration and top speed, the greatest problem when using these vehicles is the large emissions of pollutants and the noise. Furthermore, this problem is partly solved in case when the karting is used on open tracks where excellent weather conditions with no rain are generally required. However, in our region it implies usually semi-annual period, from mid-April to mid-October.

In order to enable the younger generations the use karting throughout the year, recently enclosed areas are used, specially prepared for driving karting vehicle, where special attention is paid to the ventilation space, the increased noise and high-quality surface. Finally, more attention is drawn to electric karting vehicle, which definitely has no problem with emissions of pollutants and noise. Today one can meet karting electric vehicles that are specially making for this purpose, but the question is whether the same vehicle to be reached by reconstructing existing karts with petrol engine. The answer to this question is given in this paper.

2. REDESIGN OF EXISTING PETROL KARTING

As the basis for the redesign, a classic karting with a petrol engine with 5 kW powered is used, which is shown in the Figure 1.

Figure 1. A classic existing karting with petrol engine

In order to make modification in to electric karting, from a classic karting, the gas tank and the gasoline engine were removed, and instead of these components there is a need for deployment electrical components. With the objective of maintaining a similar dynamic performance, the BLDC synchronous electric motor by company Golden Motor [1] was elected, with the power of 5 kW, voltage 48 V and its controller 48 V / 360 A, accelerator pedal and the other components. Drive of electric motor is achieved by Li-Fe-Po battery with 16 cells, a single voltage of 3.2 V, which ultimately provides a total voltage in the range of 44.8 to 51.2 V. In order to symmetry loads, the batteries are arranged on the left and right side of the driver in special carriers, and connected in series to provide a nominal voltage of 48 V. The redesigned karting is given in the Figure 2.

Figure 2. The electric karting and scheme of electrical installation

As has been mentioned, the greatest problem in designing electric karting was location of batteries and getting symmetrical loads on the left and right side. Finally, the 16-cell battery, divided into 8 to the left and 8 to the right, and their fixation is ensured by the use of specific carriers. These carriers have been implemented in the form of boxes and placed on the left and right side of the driver's seat, which can be seen in the Figure 3. In order to increase security, in terms of avoiding a side impact in the Li-Fe-Po battery and possible leakage and explosion, side protectors are retained additional.

An additional challenge for the redesigned construction of electric karting chassis has been making an electric motor carrier. Having in mind that there are no present torsional oscillations about the axis on the electric motor, a support structure is performed by a plate that is specifically placed and welded to the rest of the chassis structure, which is also seen in the Figure 3. The entire structure of karting chassis is loaded realistic with the associated loads (driver, battery, electric motor, electrical installation, etc.), while using a computer program Solid works [2], the appropriate strains and deformations have been obtained. The Figure 4 shows the loads of the structure in terms of the factor of safety.

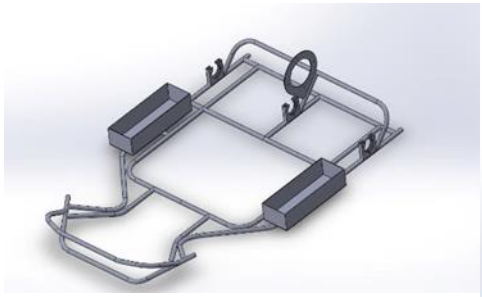

Figure 3. Redesigned model of karting chassis

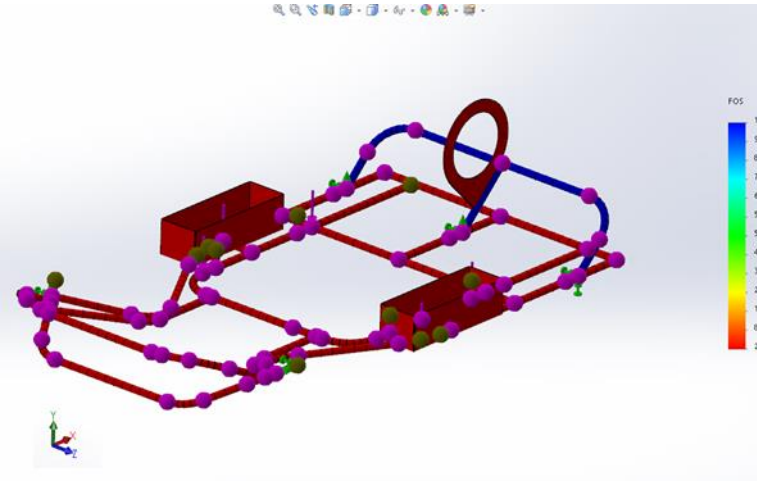

Figure 4. Structural analysis of karting chassis – factor of safety

3. INVESTIGATION OF DYNAMIC CHARACTERISTICS

After completion of the numerical and mathematical calculations, it is started with the specific modifications on karting, setting the battery, electromotor and other electrical installations. The final design of electric karting is shown in the Figure 2. A special attention was dedicated to the study of dynamic characteristics of electric karting [3]. The investigations of the dynamic characteristics was performed on the test track near the Airport Mostar [4]. In these experiments, an acceleration time during 10 consecutive measurements, then achieving

maximum speed and check the stability of the karting during motion in the slalom test were defined. The results of 10 consecutive acceleration to speed of 50 km/h are shown in the Figure 5. To define the dynamic characteristics of electric karting, the GPS device manufactured by company Racelogic [5], model VBOX sport, with frequency of 20 Hz and precision in measurement of speed of 0.1 km/h was used.

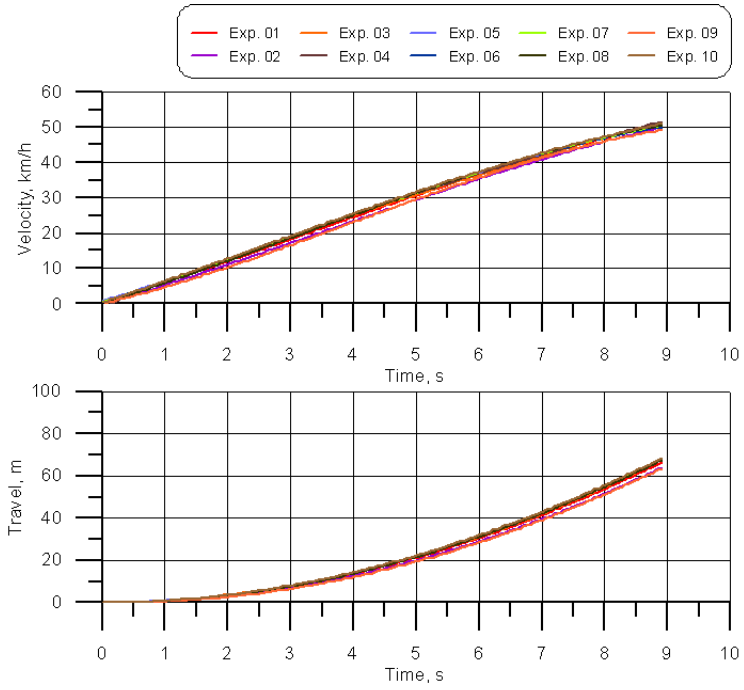

Figure 5. Velocity and travel of electric karting during acceleration tests

Based on these results one can conclude that all measurements were made within the required limits. It leads to the conclusion that used batteries can provide a safe and quality supply to electric motor during successive tests and almost the same results during accelerations.

Figure 6. Acceleration test on the test track

Figure 7. Slalom test on the test track

During testing on the test track it was found that the maximum speed of the electric karting is almost 90 km/h. In order to achieve the maximum speed the necessary time is almost 35 s. Successful mastering of the slalom test was carried out at a speed of 72 km/h, which is due to low center of gravity and a relatively large distance between the cones of 18 m.

4. CONCLUSIONS

This project demonstrate a successful procedure of making the first electric karting in Bosnia and Herzegovina. In realization of this project, the basis was existing karting with petrol engine. The second step was selection and buying electrical equipment (electromotor, batteries and other electrical installation). Finally, the existing karting was redesigned and all electrical equipment was placed on the karting chassis. Price of reconstruction amounted to 4,000 € which is significantly less than the cost of new electric karting which are offered on the market. The dynamic characteristics of electric karting are excellent. The electric karting is the great idea for use in halls (closed spaces) during winter season because there are no toxic air pollution with small noise. A one problem could be the duration of the batteries life per cycle, in the case of long lasting use. From this reason it is suggested to insure another set of batteries for all day use.

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