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Studenți din 12 universități din România și Republica Moldova au participat la Concursul internațional de inginerie a autovehiculelor „Prof. univ. ing. Constantin GHIULAI"

- Soluții dezvoltate de Schaeffler pentru viitoarele autovehicule
- Impactul ecologic al utilizării biocarburanților
- Criptare asimetrică pentru autovehiculele autonome
- Proiectul Skillful
- Sistem de încălzire a scaunelor folosind radiații infraroșii

SIAR ESTE MEMBRĂ

FISITA INTERNATIONAL FEDERATION OF AUTOMOTIVE ENGINEERING SOCIETIES

EAEC EUROPEAN AUTOMOBILE ENGINEERS COOPERATION

PUNŢI ŞI SUSPENSII PENTRU AUTOMOBILE: CONSTRUCȚIE ȘI PROIECTARE
AXLES AND SUSPENSIONS FOR AUTOMOBILES: CONSTRUCTION AND DESIGN

Autori (Authors): **Alexandru DOBRE, Viorel MATEESCU**

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Necesitatea de a studia punţile şi suspensiile automobilelor provine din faptul că acestea sunt riguros corelate cu destinaţia şi organizarea generală a automobilelor, sunt influenţate şi, la rândul lor influenţează toate sistemele principale care compun automobilul modern. Cercetările ştiinţifice şi progresele tehnologice din ultimii ani scot în evidenţă evoluţii semnificative privind creşterea performanţelor dinamice ale automobilelor, îmbunătăţirea siguranţei active şi a confortului pasagerilor, influenţe asupra rezolvării problemelor legate de optimizarea proceselor de propulsie şi de frânare. Punţile şi suspensiile autovehiculelor au parcurs numeroase etape de evoluţie: pentru punţi s-a trecut treptat de la puntea rigidă la puntea fracţionată (cu varianta sa modernă - puntea multibraţ), apoi la puntea activă, iar pentru suspensii de la suspensia pasivă, la cea semi-activă şi în cele din urmă la cea activă, cu scopul de a obţine o îmbunătăţire substanţială a performanţelor dinamice şi a confortului pasagerilor. Pentru a se înţelege cum funcţionează un sistem modern de punţi şi suspensii este necesar ca mai întâi să se aprofundeze construcţia şi funcţionarea lor, cu limitările şi constrângerile specifice.
Lucrarea este structurată pe două părţi. Prima parte este dedicată punţilor: se tratează rolul funcţional şi clasificarea, se prezintă şi analizează soluţii constructive reprezentative de punţi care se folosesc pe diferite categorii de automobile, se studiază cinematica mecanismelor punţilor, se prezintă metode şi modele de calcul şi de proiectare ale punţilor. A doua parte este consacrată sistemului de suspensie riguros corelat cu puntea pe care se montează: se prezintă rolul funcţional, modelarea matematică, construcţia, clasificarea şi soluţii constructive de suspensii, precum şi elemente de calcul şi de proiectare.

The axles and suspensions went through numerous evolution steps; starting from the rigid axle, then the fractionated (with the modern version multilink axle) and finally to the active axle, and for the suspension, from the passive suspension, to the semi-active and finally the active suspension; all these steps had the purpose to obtain a substantial improving for the dynamic performances and for the passenger comfort.
The paper is structured on two parts. The first part is about the axles: here it is presented the functional role and the classification also this part analyzes the different constructive versions used on the diverse automobile categories, studies the mechanism kinematics and finally presents methods and models for calculation and design for the axles. The second part talks about the suspension system rigorously correlated with the axle that is mounted on: presenting the functional role, the mathematic modeling, construction, the classification and the different versions of suspensions and of course the calculation and design elements for the suspensions.

SISTEME DE PROPULSIE HIBRIDE PENTRU AUTOVEHICULE
HYBRID PROPULSION SYSTEMS FOR ROAD VEHICLES

Autor (Author): **Valerian CROITORESCU**

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ISBN 978-606-515-697-5

Lucrarea prezintă direcțiile de dezvoltare ale automobilelor și tendințele specifice sistemelor de propulsie ale acestora în condițiile constrângerilor impuse de reducerea impactului asupra mediului înconjurător, aspect ce a accelerat evoluția sistemelor de propulsie hibride electrice.
Sunt detaliate sistemele de propulsie hibride, mediile de stocare a energiei electrice, mașinile electrice utilizabile și transmisiile adecvate acestor sisteme.
Lucrarea este structurată pe următoarele capitole:

Introducere | Direcţii de dezvoltare a autovehiculelor | Clasificarea sistemelor de propulsie hibride | Elemente indispensabile sistemelor de propulsie hibride electrice | Stocare cinetică | Stocare hidropneumatică | Stocare electrică | Cicluri de deplasare | Bibliografie

The paper presents the road vehicles development strategies and the specific trends regarding their propulsion systems under the regulations imposed by reducing the environmental impact, which accelerated the hybrid electric propulsion systems evolution.
The design for hybrid propulsion systems, power storage systems, already operating electric machines and adequate transmissions for these systems are presented.
The paper is structured in the following chapters:

Introduction | Vehicle development strategies | Classification of hybrid propulsion systems | Mandatory systems for hybrid electric propulsion systems | Kinetic energy storage systems | Hydropneumatic energy storage systems | Electrical energy storage systems | Driving cycles | Bibliography

Lucrările prezentate fac parte din fondul bibliografic al Centrului de documentare al SIAR.

#SIAR2017: TEMPUS FUGIT...

Când am început să reflectez la acest text, nu am putut să nu mă gândesc la editorialul scris anul trecut, în aceeași perioadă; nu am putut să nu mă întreb: *oare unde a zburat timpul?...* Așadar, mi-am zis să scriu acest editorial sub semnul trecerii timpului. Desigur, o trecere ireversibilă a timpului, însă, aș zice, însoțită de multe realizări ale SIAR.

SIAR este o comunitate de oameni ce doresc să dea un sens frumos existenței sale. Suntem preocupați de ideea utilității pentru comunitatea din care facem parte. De aceea, scopul nostru principal este organizarea și derularea unor activități/evenimente **utile** pentru beneficiarii noștri. Așadar, ce a marcat anul 2017? Ținând cont că orice sfârșit de an este și un moment de bilanț, cele ce urmează reprezintă un rezumat ale celor realizate în cadrul SIAR, în acest an.

27 ianuarie 2017: constituirea Alianței Academice pentru Ingineria Autovehiculelor și a Transporturilor (ALIAT), având ca scop dezvoltarea învățământului universitar în domeniile Ingineria Autovehiculelor și Ingineria Transporturilor și amplificarea impactului acestuia asupra mediului socio-economic; 9 universități naționale fac parte din ALIAT.

18-19 mai 2017: patronarea celei de-a 7-a ediții a competiției studențești Challenge Kart Low Cost; înainte de a fi o competiție de sport cu motor, KLC este o competiție de proiecte de inginerie, având ca scop replicarea la scara redusă a celor care au loc în industrie.

19-21 iulie 2017: organizarea primei ediții a universității de vară în domeniul Ingineriei Autovehiculelor (UNIvIA), mulțumită implicării Registrului Auto Român

08-10 noiembrie 2017: organizarea celei de-a 28-a ediții a congresului anual al SIAR la Universitatea din Pitești, CAR2017, având motto-ul „Academia, Industry and Government: together for automotive engineering development", ca indicație clară a dorinței SIAR de a fi o interfață în cadrul acestei relații tripartite ce trebuie să funcționeze foarte bine. O prezentare detaliată a celor întâmplate în cadrul CAR2017@Universitatea din Pitești, poate fi lecturată chiar în acest număr al revistei noastre.

09 noiembrie 2017: desfășurarea, în paralel cu lucrările Congresului CAR2017, a fazelor pe țară ale Concursului studențesc de inginerie a autovehiculelor „Prof. univ. ing. Constantin GHIULAI" la cele două secțiuni: „Dinamica autovehiculelor" (ediția a 4[a]) și „Automotive Computer Aided Design – CATIA" (1[a] ediție), cu participarea a 49 studenți, reprezentând 12 universități din România și Republica Moldova, câștigători ai fazelor locale.

Cât de bine a fost în 2017, îi invit pe membrii noștri să reflecteze și să stabilească. De asemenea, pentru că rațiunea de a fi a SIAR este legată de aducerea la viață a unor acțiuni **utile** beneficiarilor săi, îi rog pe cei care ne citesc să reflecteze și la alte moduri de a ameliora funcționarea SIAR. Nu putem conta pe o dezvoltare reală fără un dialog eficient, așadar, să fim aproape unii de alții pentru binele tuturor.

Închei textul meu în stilul în care l-am încheiat și anul trecut: mai întâi, îmi iau îngăduința să recomand piesa celor de la Coldplay – *„A head full of dreams"* (mai ales, studenților noștri, dar nu numai); apoi, la final de an, membrilor SIAR le mulțumesc pentru sprijinul acordat, le urez sănătate, fericire, putere de muncă și le transmit invitația de a se implica în continuare, în acțiunile SIAR pentru a face, **împreună**, din SIAR o organizație mai bună.

Adrian CLENCI,
Președinte al SIAR
Director al Departamentului Autovehicule și Transporturi,
Universitatea din Pitești

SUMAR „INGINERIA AUTOMOBILULUI" NR. 46

Contact:
Calea Griviţei 391 A,
sector 1, cod poştal 010719,
Bucureşti, România
Tel/Fax: 021/202.70.17
E-mail: autotest@rarom.ro
www.rarom.ro
www.autotestmagazin.ro

SIAR

Contact
Facultatea de Transporturi
Universitatea Politehnica
Bucureşti
Splaiul Independenţei 313
Sala JC 005, Cod poştal 060042, sector 6, Bucureşti, România
Tel/Fax: 021/316.96.08
E-mail: siar@siar.ro
www.ingineria-automobilului.ro
www.siar.ro
https://www.facebook.com/SIAR.FISITA/

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Str. Lt. Col. Dumitru Petrescu nr. 20
Târgu-Jiu

SOCIETATEA INGINERILOR DE AUTOMOBILE DIN ROMÂNIA

COMITETUL ŞTIINŢIFIC

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CAR 2017 – Congresul Internațional de Inginerie a Autovehiculelor şi Transporturilor

Al 28-lea Congres Internațional al SIAR de Inginerie a Autovehiculelor şi Transporturilor

„MOBILITY ENGINEERING AND ENVIRONMENT”

08 - 10 Noiembrie 2017, Piteşti, România

Deja consacrat pe plan internațional, beneficiind de peste 20 de ani de patronajul Federației Internaționale a Societăților Inginerilor de Automobile – FISITA (The International Federation of Automotive Engineering Societies), Congresul Internațional al SIAR de Inginerie a Autovehiculelor şi Transporturilor Rutiere s-a desfăşurat în perioada 08 – 10.11.2017 la Universitatea din Pitești în organizarea Departamentului Autovehicule şi Transporturi.

Eveniment ştiinţific major în comunitatea cercetătorilor, cadrelor didactice universitare şi a altor specialişti din domeniul ingineriei autovehiculelor, transporturilor şi siguranței rutiere, Congresul Internațional de Inginerie a Autovehiculelor şi Transporturilor Rutiere – CAR 2017 a avut la bază experiența acumulată de-a lungul a 10 edițiii anterioare, organizate în anii 1978, 1982, 1985, 1989, 1992, 1994, 1997, 2000, 2005 şi 2011.

Congresul Internațional de Inginerie a Autovehiculelor şi Transporturilor Rutiere – CAR 2017 a fost organizat de Departamentul de Autovehicule şi Transporturi din cadrul Facultății de Mecanică şi Tehnologie a Universității din Pitești, unul dintre centrele naționale de excelență în cercetarea aplicativă şi fundamentală din domeniul ingineriei autovehiculelor şi transporturilor, cu o largă recunoaștere internațională şi puternic ancorat la mediul economic specific favorizat de prezența în zonă a DACIA, Renault Technologie Roumanie şi a companiilor ce asigură diverse subansambluri sau componente.

Congresul a fost însoțit de un ansamblu de manifestări care au atras atenția specialiştilor prezenți la Pitești cu această ocazie. Congresul CAR 2017 împreună cu celelalte activități specifice ingineriei autovehiculelor şi transporturilor organizate într-o strânsă corelare au oferit prilejul stabilirii unor contacte utile de colaborare şi informare în domeniul problemelor actuale privind dezvoltarea autovehiculelor, siguranța transporturilor rutiere, protecția mediului etc.

Printre factorii determinanți în dezvoltarea domeniului ingineriei autovehiculelor se numără schimbul activ de idei şi cunoștințe, aspect ce caracterizează societatea actuală. Într-o concepție sistemică adoptată de SIAR pentru congresele sale – „Academia, Industry and Government: together for automotive engineering development”, un număr important

de specialişti din mediile academic, social şi economic din ţară şi de peste hotare au participat la lucrările congresului, fapt ce a permis abordarea în profunzime a temelor importante care preocupă societatea contemporană privind rolul, locul şi dezvoltarea viitoare a autovehiculelor.

Temele propuse pentru Congresul Internaţional de Inginerie a Autovehiculelor şi Transporturilor Rutiere – CAR 2017 într-un context generos „Mobility Engineering and Environment” au asigurat un cadru ştiinţific adecvat unor schimburi de idei şi dezbateri intense şi obiective, au reflectat aceste preocupări din domeniul ingineriei autovehiculelor şi transporturilor, fiind orientate pe următoarele direcţii: expertiza evenimentelor rutiere; securitate activă şi pasivă; metode avansate în ingineria autovehiculelor (CAx); materiale avansate, tehnologii de fabricaţie şi logistică; sisteme avansate de transport şi trafic rutier; autovehicule grele şi speciale; autovehicule electrice şi hibride; motoare cu ardere internă; transmisii; electronică şi software pentru autovehicule.

Cei peste 250 participanţi la congres au avut ocazia de a se implica activ la lucrările ştiinţifice prezentate în sesiunea plenară, cât şi în cadrul multiplelor secţiuni desfăşurate simultan, work-shop-uri şi dezbateri, expoziţii, vizite tematice, activităţi sociale.

În cadrul ceremoniei de deschidere a congresului, domnul Adrian CLENCI – preşedintele SIAR, preşedintele Comitetului de organizare şi director al Departamentului Autovehicule şi Transporturi din Universitatea din Piteşti, după salutul adresat participanţilor l-a invitat pe Rectorul Universităţii din Piteşti – domnul Dumitru CHIRLEŞAN, să adreseze mesajul său participanţilor la congres. În continuare, au prezentat mesaje delegaţilor prezenţi la Congresul CAR 2017 Gunter HOHL reprezentant FISITA, vicepreşedinte al Austrian Society of Automotive Engineers - OVK Austria, fost vicepreşedinte FISITA şi fost preşedinte EAEC, domnul Pascal CANDAU – manager general la Renault Technologie Roumanie, domnul Stefan KANYA, – Director AVL Romania, domnul Rainer THIELE - Director Business Development la FEV, domnul Gabriel SICOE – Preşedinte ACAROM.

După ceremonia de deschidere a congresului care a avut loc în corpul central al Universităţii din Piteşti, s-a trecut la prezentarea lucrărilor în plen.

Prima lucrare, „Electric vehicle. Renault driving the electric revolution” susţinută în plen de Nicolas SCHOTTEY, Program Director New Business Energy, Renault, a abordat o temă de primă importanţă în această perioadă, descriind preocupările de dezvoltare ale Renault în domeniul autovehiculelor electrice, evocând perioada de pionierat şi accentuând pe soluţiile performante actuale. Dintre provocările ce stau în faţa specialiştilor preocupaţi de proiectarea de noi autovehicule electrice

sunt amintite: creșterea autonomiei, reducerea costurilor, reducerea timpilor de reîncărcare a bateriilor.

Lucrarea „Trends in gasoline powertrain technology for high performance and low emission"- susținută de Hubert FRIEDL - Product Manager Gasoline Engines la AVL List, Austria, a evidențiat preocupările și realizările companiei sale în domeniul dezvoltării soluțiilor aplicabile pentru determinarea/reducerea emisiilor poluante la motoarele alimentate cu benzină și creșterea performanțelor acestora. Soluția de realizare a bielei telescopice concepută modular la AVL pentru realizarea unui raport de comprimare variabil constituie una dintre aplicațiile cu o eficiență sporită, permițând o variație a raportului de comprimare cu 3-6 unități.

Christoph MENNE, Director Vehicle Application, Diesel Powertrain, Europe la FEV Group, Germania, a susținut în continuare lucrarea „Clean air and high efficiency – the diesel engine of the upcoming decade". Descriind contextul generat de prescripțiile din ce în ce mai severe privind reducerea emisiilor poluante și proiecția problematicii la nivel mondial în viitor, s-au evidențiat preocupările FEV în conceperea de soluții performante pentru reducerea emisiilor poluante ale motorului cu aprindere prin comprimare.

În continuare Markus BÖCK (Product Manager PEMS, Horiba GmbH, Germania) a prezentat în plen lucrarea „The continuous rise of real driving emissions" evidențiind stadiul și tendințele dezvoltării sistemelor PEMS (Portable Emissions Measurement Systems), precum și preocupările Horiba în acest domeniu.

Lucrările pe secțiuni au fost prezentate într-un cadru multifuncțional asigurat în corpul central al Universității din Pitești.

După lansarea invitațiilor de participare la congres, au fost primite 193 de propuneri (rezumate), din care 156 au fost admise pentru etapa de peer-review, fiind în final acceptate pentru prezentare și publicare 129 de lucrări. Dintre acestea, 116 au fost susținute în cadrul secțiunilor tehnice organizate în cadrul congresului. Pentru primirea și evaluarea lucrărilor a fost utilizată o platformă modernă de management al conferințelor (http://www.car2017.ro).

Lucrările prezentate în congres au fost publicate în două volume: IOP Publishing Ltd, UK (IOP Conference Series: Materials Science and Engineering - CAR2017 International Congress of Automotive and Transport Engineering – Mobility Engineering and Environment, 8–10 November 2017, Pitesti, Romania) și Buletinul Științific al Universității din Pitești – seria Autovehicule Rutiere.

La lucrările Congresului au participat cadre didactice universitare, cercetători și specialiști din domeniul ingineriei autovehiculelor și

transporturilor din Austria, Bulgaria, Cehia, Franţa, Grecia, Germania, Italia, Irak, Israel, Polonia, Serbia, Suedia, SUA, Republica Moldova şi din România.

Congresul a prilejuit atât prezentarea rezultatelor activităţilor de cercetare desfăşurate, cât şi schimburi de opinii pe diverse teme de interes. Astfel, menţionez întâlnirile ALIAT- Alianţa Academică pentru Ingineria Autovehiculelor şi Transporturilor şi a Consorţiului Naţional de Inginerie Economică.

S-au organizat şi două conferinţe speciale în care prof. dr. ing. Corina SANDU de la VirginiaTech (SUA) a prezentat sistemul de învăţământ universitar din Statele Unite, iar domnul Stefan HERRMAN, Project Manager, FEV, Germany a susţinut lucrarea „Engine-in-the-loop testing. Simulation of real driving scenarios at the engine test bench".

Pe durata congresului s-au organizat două dezbateri pe teme de interes deosebit pentru specialiştii din domeniul ingineriei autovehiculelor, astfel:

„Hybrid Electric Vehicles & Battery Electric Vehicles", moderator conf. univ. dr. ing. Dănuţ MARINESCU (Universitatea din Piteşti), cu participarea următorilor experţi tehnici: Nicolas SCHOTTEY (Renault), Francois BADIN (IFP), Stefan KANYA (AVL);

„Real Driving Emissions via Portable Emissions Measurement Systems" moderator conf. univ. dr. ing. habil. Adrian CLENCI (Universitatea din Piteşti), cu participarea următorilor experţi tehnici: Bruno TISSIER (Renault), Hubert FRIEDL (AVL), Marcus BÖCK (Horiba), Christoph MENNE (FEV).

Pe durata congresului s-a organizat o vizită tehnică la Renault Technologie Roumanie - Centrul Tehnic Titu, completată de un scurt, dar foarte frumos program social: vizitarea Vilei Florica, din cadrul Centrului de Cultură „Brătianu".

Desfăşurarea în paralel cu lucrările Congresului CAR 2017 a fazelor pe ţară ale Concursului internaţional studenţesc de inginerie a autovehiculelor „Prof. univ. ing. Constantin GHIULAI" la cele două secţiuni „Dinamica autovehiculelor" (ediţia a patra) şi "Automotive CAD – CATIA V5" (prima ediţie) cu participarea a 49 studenţi reprezentând 12 universităţi din România şi Republica Moldova, câştigători ai fazelor locale, a contribuit din plin la construirea în rândul participanţilor a unei imagini optimiste, pline de încredere în viitorul ingineriei autovehiculelor în România.

Studenţii participanţi la concurs au avut şi o activitate specială organizată împreună cu specialiştii RAR de prezentare şi vizionare a unuia dintre laboratoarele mobile utilizate în cadrul programului „PEMS - Portable Emissions Measurement Systems".

Pentru toţi participanţii, Congresul Internaţional de Inginerie a Autovehiculelor şi Transporturilor – CAR 2017 rămâne o manifestare ştiinţifică de referinţă în multiple planuri, cu un program complex, variat şi interesant. Felicităm comitetul local de organizare şi invităm participanţii la următoarea ediţie a congresului anual al SIAR ce se va desfăşura la Universitatea Tehnică din Cluj-Napoca -AMMA 2018!

Prof. dr. ing. Minu MITREA
Secretar General SIAR

CHASSIS OPPORTUNITIES FOR THE FUTURE – UNIQUE ACTUATORS & APPLICATIONS SOLUTIONS MADE BY SCHAEFFLER

SOLUȚII INTEGRATE DEZVOLTATE DE SCHAEFFLER PENTRU VIITOARELE ŞASIURI DE AUTOVEHICULE

ABSTRACT
The actual technologies in terms of driver assistance and the future technologies of autonomous driving, brings forward the need of mechatronic chassis systems. In the 1990s Schaeffler began development of mechanical actuators (ball screw drive, small planetary gear, cylindrical gear units and the bearing support for the entire module) for electromechanical brakes. Nowadays the Electromechanically Active Roll Stabilizer already defined his presence on the market. Within this paper are presented Schaeffler's unique solutions for all this challenges in the area of vehicle roll stabilization , ride height adjustment, steering, damping and wheel bearings.
Key-Words: *Electromechanical actuator, chassis system.*

Manfred KRAUS[1]
kraus.manfred@schaeffler.com

Harald HOCHMUTH[1]

Hartmut KREHMER[1]

Markus BAEUML[1]

Roland LANGER[1]

Florin DOBRE[2]

1. Schaeffler Technologies AG&Co. KG, Industriestraße 1-3, 91074 Herzogenaurach, Germany
2. S.C. Schaeffler Romania S.R.L., Aleea Schaeffler Nr. 3, 507055 Cristian/Braşov, Romania

1. INTRODUCTION

When it comes to developing chassis, today's challenges go far and above the traditional conflict of having a comfort-based and sportive set-up. A whole host of benefits is associated with electrification of the chassis. The actual technologies in terms of driver assistance and the future technologies of autonomous driving, brings forward the need of mechatronic chassis systems. Above that, the emission regulations calls for energy efficient systems. From this point of view the electromechanical actuator comes with the advantage of power on demand and higher efficiency compering with electro-hydraulic systems. Last, but not least cost efficient systems is nowadays a big challenge of the market. In the 1990s Schaeffler began development of mechanical actuators (ball screw drive, small planetary gear and cylindrical gear units and the bearing support for the entire module) for electromechanical brakes. Nowadays the Electromechanically Active Roll Stabilizer (emARS) already defined its presence on the market. Figure 1 shows the technologies and their penetration in the individual vehicle segments.

1.1. Requirements of chassis of the future

Stringent requirements regarding CO2 reduction also mean that chassis technology will have to utilize the potentials provided by lightweight construction, friction reduction and more efficient actuators [1]. This is accompanied by the use of new materials or existing materials with optimized characteristics in terms of rigidity and strength. What's more, many chassis systems are also used as a way of making vehicles stand out within a platform. Figure 2 shows an overview of the current trends.

Nowadays, buzzwords such as connectivity, autonomous or semi-autonomous driving have a considerable bearing on chassis development[2]. Related to this development is, ultimately, a modified safety strategy; for instance extended latency periods requiring the basic mechanical function to be protected. This protection may also necessitate enhanced or additional redundancy/safety state. In light of these possibilities, new requirements will be demanded of existing actuators. What's more, actuators, sensors and systems are increasingly networked to generate new overarching functions, to increase availability and to improve safety. This could be achieved, for instance, by a mutual plausibility in the context of a safety concept according to ISO 262622. Key elements of the future thus include cameras, sensors, antennas, as well as corresponding software for networking in the vehicle and with the environment [3]. Of key importance is the increase in the use of camera and radar-based as well as laser-based systems. These

Characteristic	Function	Segment				
		A Sub A	B B-SUV	C C-SUV	C/D CD-SUV	D D-SUV
Lateral dynamics	Electric steering	S	S	S	S	S in future
	Anti-roll system				O	O
	Rear-wheel steering				O	O
	Superimposed steering				O	O
	Torque vectoring					O
Vertical dynamics	Variable dampers		O	O	O	S
	Air springs				O	S/O
	Level control		O[2]	O[2]	O[2]	
	ABC (active body control)					S/O
Longitudinal dynamics	Electronic parking brake		S/O	S	S	
	Electronic brake booster	S[1]	S[1]	S[1]	S in future	S in future
Driver assistance system	Lane departure warning			O	O	O
	Emergency braking assist		O	O	O	O
	Traffic jam assist			O	O	O
	....					
Self-driving vehicles						2017/18[3]

S = standard feature
O = optional feature
1) will be standard feature on electric vehicles
2) SOP = 2017 onwards
3) Semi-self-driving

Fig. 1. Chassis technologies and their penetration in various vehicle segments

Drivers	Urbanisation		Product differentiation	
Trend	Reduction in CO_2 emissions	Affordable travel	Comfort and safety	Driving pleasure
Measures	e-mobility/ hybridisation	Platform strategy	Self driving vehicles	Extension of platform strategy functions
	Friction reduction	New chassis layouts/concepts	Network/ connected driving	New chassis applications
	Lightweight design	Cost optimised solutions	New vehicle concepts	New vehicle concepts
	Demand-based control	Car sharing	New chassis applications	
	Energy recuperation		Technology aimed at older drivers	

Fig. 2. Trends in chassis technologies

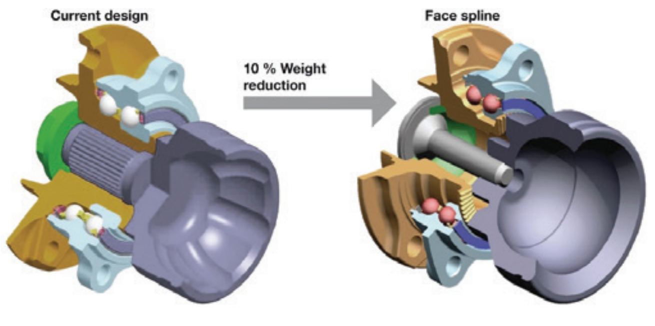

Fig. 3. Wheel bearing with face spline design compered with actual internal gear teeth design

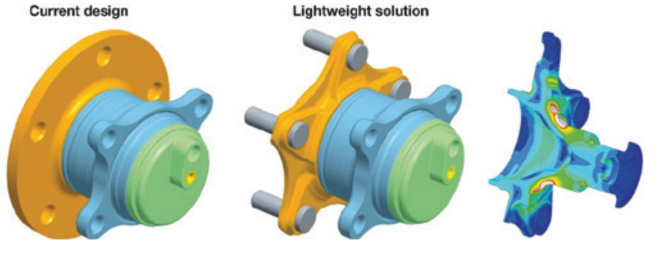

Fig. 4. Comparison of a current wheel bearing with weight-optimized flange

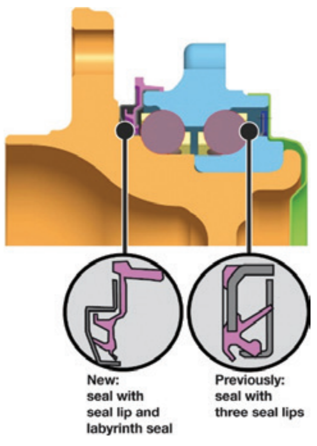

Fig. 5. Comparison of conventional seal with a friction-reduced seal

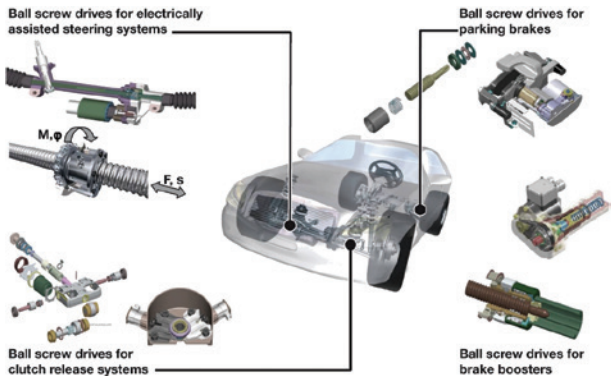

Fig. 6. Overview of ball screw drive applications

systems include polarizing and infra-red cameras, in addition to stereo ones. Used in combination with information regarding temperature and humidity, it is possible to detect aquaplaning and black ice.

2. CURRENT SCHAEFFLER SOLUTION

2.1. Weight reduction products

In the wheel bearing area, the market has seen a gradual introduction of lightweight construction solutions with face spline and weight-optimized flange design. The technology is becoming increasingly popular and is well on the way to setting a new industry standard in the foreseeable future – a standard that Schaeffler will have created. Figure 3 shows a comparison of a third-generation wheel bearing in its previous design and one with face spline.

The benefits from this technology, such as 10 % rigidity increase, 10 % weight reduction, 50 % higher transferable torque as well as a reduction in unsprung mass yet still with simple assembly process, have been utilized in series applications since 2009. An additional measure for reducing weight comes about by cutting the bearing flange weight while maintaining its rigidity. By applying numerical procedures, it has already been possible to make weight reductions of 20 % without compromising the axial rigidity. Figure 4 shows a wheel bearing with a weight-optimized flange compared with a conventional bearing flange. The result is optimized tension curves, which have also been used as a basis for an enhanced fiber flow of the flange. It is feasible to use driven and non-driven axles.

2.2. Friction reduction products

Seal friction determines wheel bearing friction to a great extent, which is why it makes sense to start there with measures designed to reduce friction. The wheel bearings offered by Schaeffler can be fitted with low-friction seals, which reduce friction by around 50 % compared to seals offered by competitors. This 50 % reduction thus makes it possible to cut CO2 emissions by around 1 g/100 km. It is worth mentioning that the sealing effect is still the same compared with today's conventional two and three-lip seals (Figure 5).

2.3. Mechanical actuators with ball screw drive for chassis applications

Many linear actuators are equipped with a ball screw drive as a mechanical actuating element. Schaeffler launched a ball screw drive for electromechanical power-assisted steering on the market as far back as 2007. This steering ball screw drive is designed along the lines of the principle of modular design and can cover a wide range of applications. It provides a virtually constantly high degree of efficiency of more than 90 % over the entire temperature range and is supplied together with a four-point support bearing. Ball screw drives and support bearings designed to meet customer requirements of minimized backlash can be provided. In parallel to this, a compact ball screw drive with a pitch diameter of up to 4 mm has been developed; this compact version has been used by Continental in its electric parking brake since 2011. Other applications based on this design are currently in the development phase — for instance, application in the electromechanically operated brake booster. Figure 6 shows other potential applications for the compact ball screw drive.

2.4. Electromechanical active roll stabilizer – emARS

Over the last few years, Schaeffler has played its role in driving the replacement of hydraulic with electromechanical systems thanks to developing an electromechanical anti-roll system. Series production of this system to started in 2015. The benefits offered by the system are:

- Little or no tilting of the vehicle when cornering as a function of the present lateral acceleration
- More accurate steering behavior, improved agility and stability
- Enhanced system dynamics compared to hydraulic systems
- Simple installation and easy maintenance
- Reduction in the number of field complaints by up to 30 % compared to hydraulic systems
- Installation in hybrid vehicles possible
- Reduction in fuel consumption of up to 0.3 liters compared to hydraulic

anti-roll systems, and
• Weight neutral compared to hydraulic systems

The system comprises a brushless direct current motor with control system, transmission, torsion bars and a decoupling unit (Figure 7).

The E/E architecture is shown in Figure 8.

To complement a pure rotary actuator and to enhance comfort, the Schaeffler solution features a decoupling element, which enables one-sided disruptions in the road surface to be absorbed. Transmitting pulses to the body is thereby also reduced as well as strong vertical motion caused by one-sided disturbance excitation. Design and function of the anti-roll system are explained in detail in [4] and [5]. The effect of the decoupling unit for small disturbance excitations is shown in Figure 9.

The decoupling unit demonstrates excellent efficiency particularly for small disturbance excitations with an amplitude of up to 5 mm. Larger disturbance excitations can be corrected by the disturbance controller. As the input parameter, this controller requires different functions, including the torque in the anti-roll system and the vertical displacement of the wheels.

The overall controller structure is shown in Figure 10. The interference can be corrected up to a frequency of approximately 8 Hz. The maximum frequency depends on the amplitude. If the information about the road surface collected by a stereo camera is available as the input signal and information from the navigation system about the route can be used, the disturbance controller can be improved still further by means of anticipation.

Alternatively, the body tilt and the effect of one-sided disturbance excitation on the body can also be prevented by hydraulically adjustable struts on each wheel. In addition to the anti-roll motion, this kind of system also prevents a pitching motion during braking and accelerating. However, this does not apply to air-sprung systems on account of the compressibility of air.

3. FUTURE SCHAEFFLER SOLUTION

3.1. Sensor layer for measuring wheel force

Schaeffler is currently developing a sensor layer for measuring wheel force; this layer can be applied to two or three-dimensional components such as bearing components. Figure 11 shows several examples of applications.

Application to the wheel bearing enables the wheel force to be measured and thus record the forces acting on the wheel, including the brake forces generated during braking. These forces can be used as an input signal for various chassis control systems. The wheel force measurement being developed at Schaeffler also enables accurate recording of the vehicle weight, which may be of interest for light commercial vehicles. The measurement principle is based on the arrangement of strain gauges on a two-dimensional or three-dimensional tensioned surface. The strain gauges are attached using thin-film technology. The basic layer design is shown in Figure 12.

The geometry of the strain gauges is “cut” into the sensor layer using laser, with a top cover attached to protect the sensor layer. To illustrate the technology, Figure 13 shows an applied sensor layer using a bearing outer ring as an example.

As proof of the measurement accuracy, it is helpful to compare this layer with a laser extensometer. Experiments with planar samples, which were stretched on a traction engine and their elongation in synchronously recorded with the sensor layer as well as using the laser extensometer, have provided fairly good correlation (Figure 14).

The past few years have seen that the process reliability of the individual process steps has been systematically demonstrated and increased. Currently, preparations for winning projects and customers are being ramped.

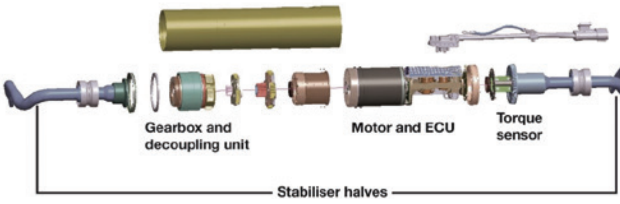

Fig. 7. Design of the anti-roll system

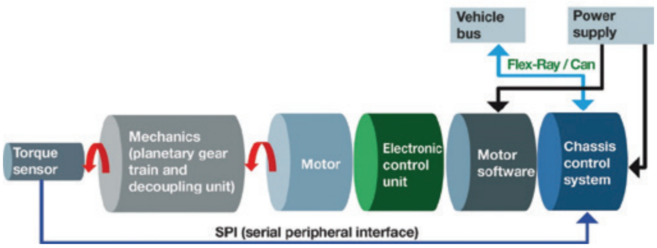

Fig. 8. System Architecture

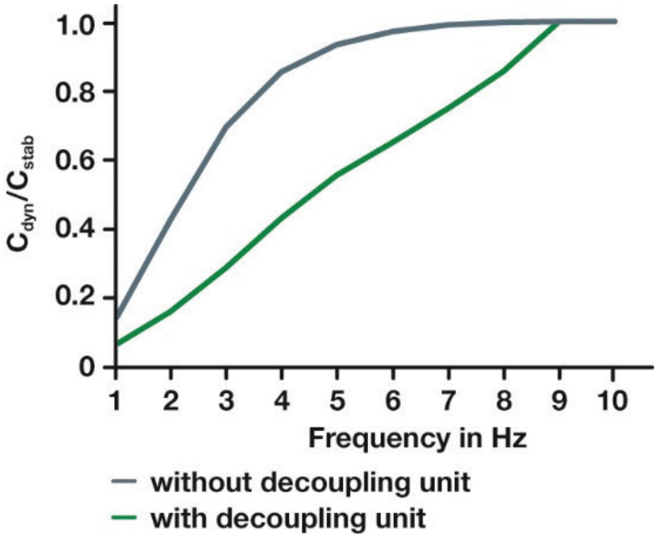

Fig. 9. Dynamic system as a function of the frequency of the one-sided disturbance excitation for systems with and without a decoupling unit

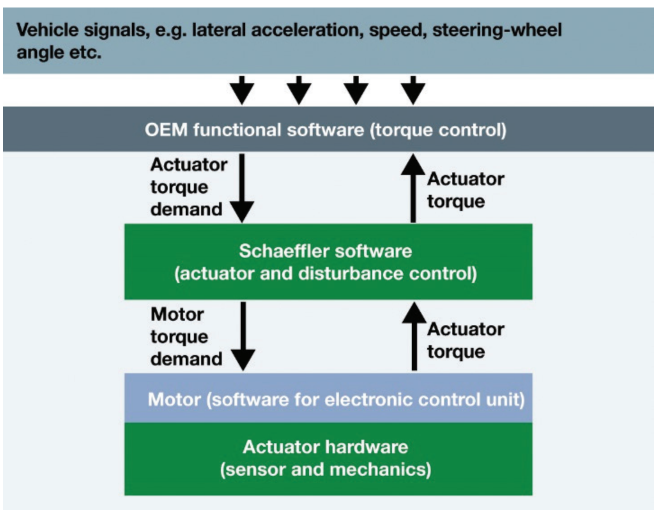

Fig. 10. Block diagram of the emARS

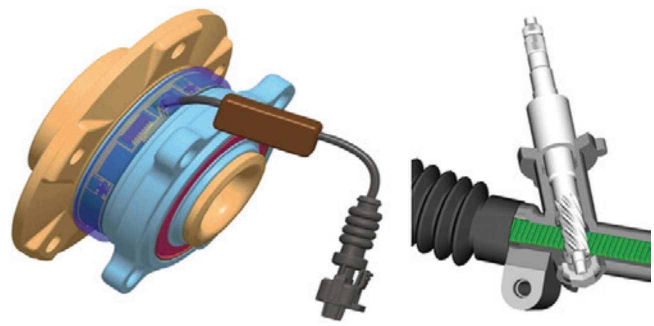

Fig. 11. Sensor layer for measuring the wheel force at the wheel bearing (on left) and for measuring the steering moment in the steering gear

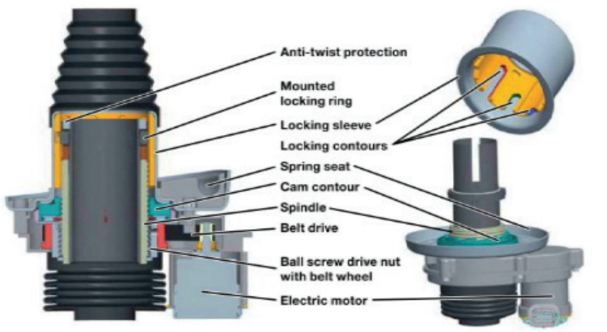

Fig. 15. Ride Height Control actuator for front axle

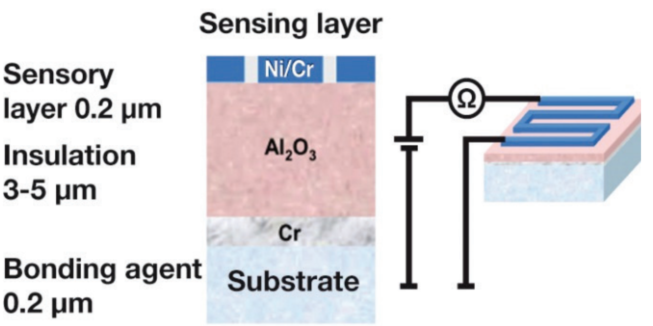

Fig. 12. Sensor layer design

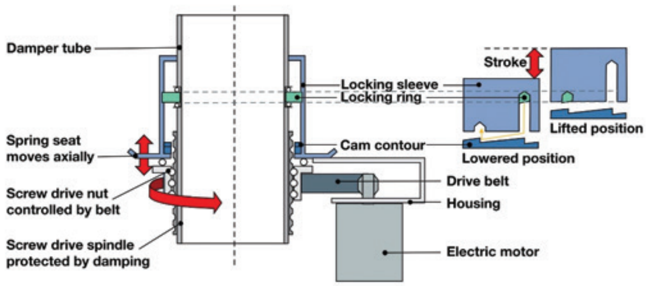

Fig. 16. Locking assembly in detail

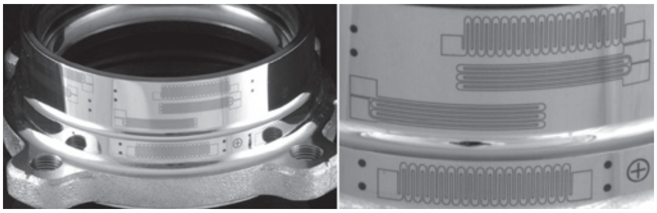

Fig. 13. Sensor layer on a bearing outer ring.

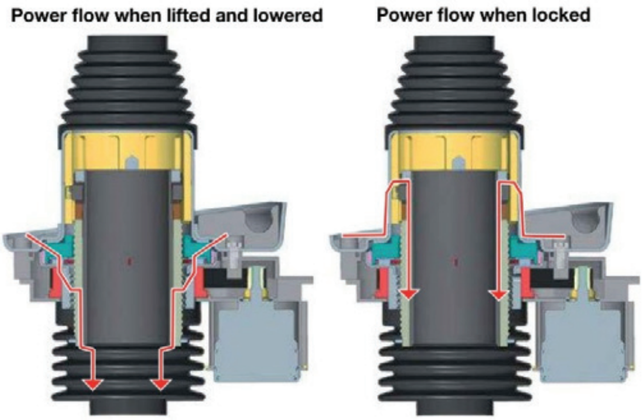

Fig. 17. Power flow during raising, lowering and locking

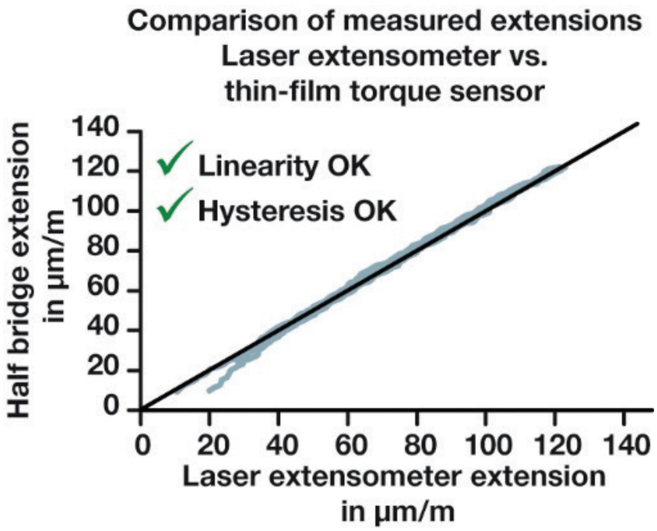

Fig. 14. Comparing the elongation of planar samples with the sensor layer

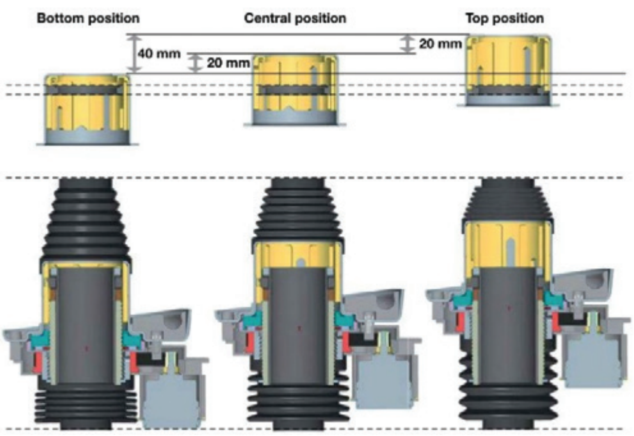

Fig. 18. Position of the actuator at different ride heights

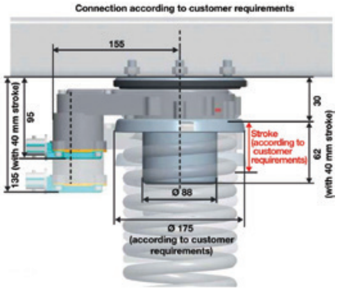

Fig. 19. Installation position of the actuator on rear axle

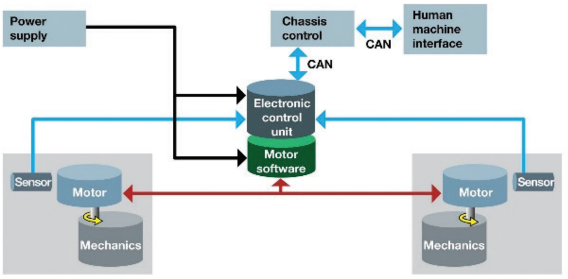

Fig. 20. System architecture

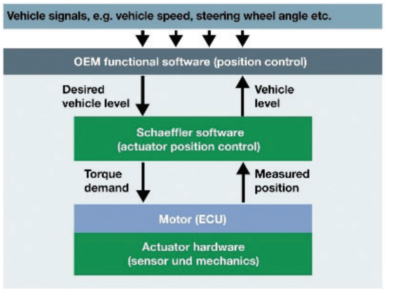

Fig. 21. System architecture

3.2. Ride height control

In today's vehicles, air suspension is used to adjust the ride height to various driving and load conditions. This suspension system can inherently absorb very poor lateral forces and is therefore not well-suited to McPherson strut axles. In addition, the costs for air springs are another reason the system has not become established in the B and C segments. Hydraulic height adjustment systems are used in the sports car sector, in particular on the front axle to make it easier to drive over ramps [6]. The tendency of markets towards potentially failure sensitive hydraulic actuators is to oppose further proliferation of this technology. There is therefore a need for electromechanical systems designed to adapt the ride height.

The following functions can be supported by this kind of system.

• Lowering the vehicle to reduce aerodynamic drag either on all four wheels or only on the front axle to bring a laden car back into the trim position

• Raising the vehicle to make it easier to get in

• Raising a sports car to protect the spoiler when driving over car park ramps

• Raising vehicles for light off-roading, as well as

• Lowering the vehicle to make it easier to load the luggage compartment

The solution developed by Schaeffler is shown in Figure 15.

The actuator essentially comprises a ball screw drive, a belt drive, an electric motor and a locking assembly. In this case, the vehicle load is not supported on the ball screw drive but on the locking assembly, which locks the vehicle's ride height. The ball screw drive itself is only used to adjust the different heights. Figure 16 shows a detailed view of the locking assembly.

The spindle is fixed on the damper to raise and lower the vehicle, while the nut is driven by a belt. The nut rotating leads to an axial displacement of the unit comprising the nut, control contour, motor, housing and spring seat, and this is what changes the ride height.

To lock the height, the locking ring engages in different locking contour grooves depending on the position when lowering. This action maintains the vehicle at the required level. As the vehicle is offset in any position on the locking ring, the drive and spindle lock remain load-free in the locked state (Figure 17).

To aid a better understanding, the three different ride heights and resulting design positions of the actuator are summarized in Figure 18. The number of grooves determines the possible ride height. A third groove means that a central position can also be realized.

The current engineering knowledge enables adjustment ranges of 40 mm, which can be extended even further depending on the available space. The selected design also allows installation on the rear axle, where dampers and springs are often arranged separately. The only action needed to accommodate this installation is to merely rotate the motor by 180° (Figure 19).

For E/E implementation, E/E components are already available on the market. Selected ECU includes two power stages, they can control two electric motors simultaneously. The resulting system architecture is shown in Figure 20.

The proposed system configuration can be seen in Figure 21.

By virtue of the actuator design, selected system architecture and proposed system configuration, the market is filled with diverse and promising applications. Preparations are currently underway to construct test vehicles this year.

4. CONCLUSIONS

In cases when the friction law (for the couple of materials used in the construction of the triboelements) higher order nonlinearities occur, the friction forces generate in the mechanical system elements noises as self-oscillations in a wide range of frequencies.

Based on Lagrange equation, the dynamic model of the interaction between the mechanical system and the tribosystem was developed. The harmonic oscillator with elastic elements was accepted as mechanical system for modelling. The examination of the dynamic model identified the structure of the friction force in unstable operating conditions of the mechanical system. In the structure of the total friction force F_f four possible components appear: a component F_c^i (of Coulomb type), defined by the linear factors of the dissipative function Φ_d; three variable (fluctuating) components within the limits of each oscillation cycle $(F_v^i)^{**}$, $(F_v^i)^{*}$, $(F_v^i)^{v}$ (occurr as a result of various dynamic effects in the contact zone with higher order nonlinearities and can vary over a wide range of frequencies and amplitudes. Based on the model with harmonic oscillator, an original model of tribometer has been made, with cyclical translational movement, equipped with proper measuring systems for the dynamic characteristics of the oscillator, and the method for experimental determination [3] of the dynamic characteristics of the sliding tribosystem in unstable operating regime was developed.

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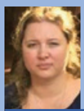
IMPACTUL ECOLOGIC AL UTILIZĂRII BIOCARBURANȚILOR

ENVIRONMENTAL IMPACT OF BIOFUELS

ABSTRACT
In the work we presents experimental research on test results exhaust the compression ignition engine fueled with various fuels (biofuels, pure oil, diesel fuel blends with biodiesel).
***Key-words:** Bio-fuels, Diesel fuel, blend diesel – biodiesel*

Lect. sup. Univ.
Eduard BANARI
edu.banari@gmail.com



Lect. univ.
Natalia MANCUȘ

Universitatea Agrară de Stat din Moldova, Str. Mircești, Nr. 56, MD-2049 Chișinău, Republica Moldova

1. INTRODUCERE

Creșterea pronunțată a fabricației de autovehicule din ultimii ani la nivel mondial poate fi alăturată unei probleme vitale pentru societatea modernă reprezentată de poluarea mediului datorată noxelor care se elimină la arderile de combustibil clasic. Din aceste motive a crescut interesul față de așa numiții carburanți alternativi. Unul dintre aceștia este și biodieselul, care se obține din uleiurile vegetale (rapiță, soia, ricin, floarea-soarelui, porumb etc) sau grăsimi animale prin esterificare cu metanol, obținându-se ca produs secundar glicerina folosită în industria de cosmetice.

Biodieselul se poate folosi ca atare sau în amestec cu motorina în diverse proporții. Dacă amestecăm motorina cu biodiesel, iar amestecul este folosit la alimentarea motoarelor cu ardere internă se va constata o reducere semnificativă la emanarea gazelor toxice.

Deoarece cerințele ecologice europene privind reducerea emisiilor de gaze nocive emanate de autovehicule sunt tot mai severe apare ca o firească preocupare folosirea biodieselului, acesta fiind un carburant nepoluant. Mai mult de atât, biodieselul este biodegradabil, intrând în ciclul de descompunere naturală [1].

Conform mai multor studii întreprinse, utilizarea biocombustibililor conduce la reducerea emisiilor de CO, CO_2, a emisiilor de pulberi în suspensie, precum și a emisiilor de sulfați [2]. Biodieselul este considerat neutru din perspectiva emisiilor de CO_2 întrucât prin ardere rezultă echivalentul de CO_2 absorbit de plante în procesul de fotosinteză.

În cadrul studiilor efectuate privind efectele asupra mediului înconjurător a utilizării biodieselului la alimentarea motoarelor cu ardere internă este deosebit de important să se studieze nu doar emisiile totale, dar și compoziția diferitelor substanțe ce sunt eliberate în atmosferă.

Lucrarea își propune să prezinte studiile efectuate asupra emisiilor poluante rezultate la alimentarea motorului cu aprindere prin comprimare cu diverse tipuri de combustibil.

2. MATERIALE ȘI TEHNICI DE ÎNCERCARE UTILIZATE

Pentru efectuarea cercetărilor experimentale asupra emisiilor poluante rezultate la alimentarea motorului cu aprindere prin comprimare cu diverse tipuri de combustibil s-a folosit motorul D-241L.

Pe durata încercărilor s-a folosit drept combustibil motorină (STAS 305-82), amestec motorină - biocombustibil în următoarele proporții: 80/20 (B20) și 50/50 (B50), precum și biocombustibil pur 0/100 (B100).

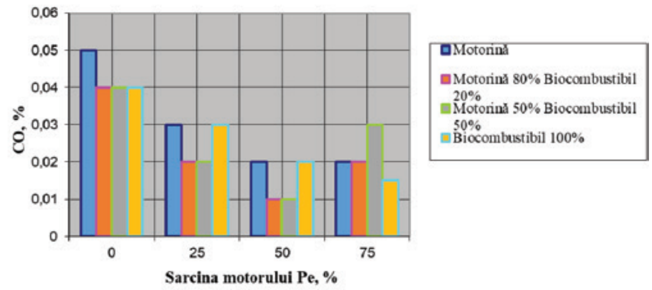


Fig. 1. Emisia de CO în gazele de eșapament în raport cu sarcina motorului

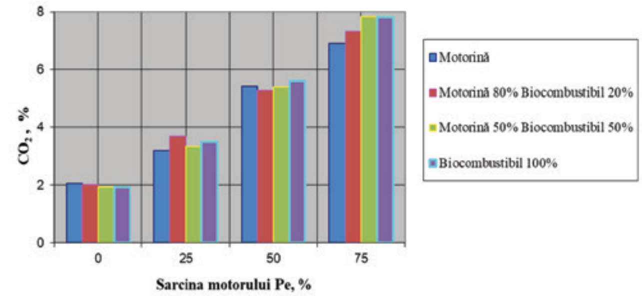


Fig. 2. Emisia de CO_2 în gazele de eșapament în raport cu sarcina motorului

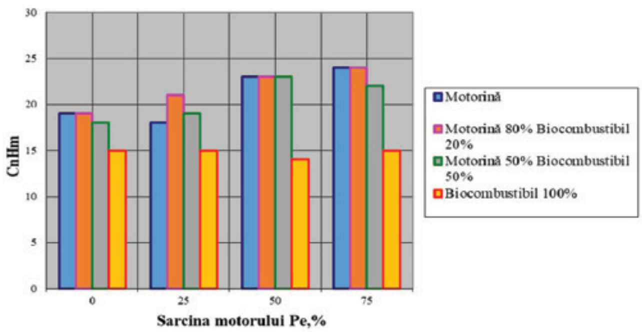


Fig. 3. Emisia de C_nH_m în gazele de eșapament în raport cu sarcina motorului

Concentrația componenților poluanți în gazele de eșapament s-a determinat la capătul țevii de eșapament folosind analizatorul de gaze de tip KARTEK CET- 2000. Turațiile arborelui cotit pentru fiecare măsurare au fost stabilite la 1000, 1800 și 2100 min^{-1}; sarcinile motorului: 0; 25%; 50%; 75% Pe.

3. REZULTATE

Analizând și prelucrând datele experimentale obținute la încercarea motorului cu aprindere prin comprimare la funcționarea cu diverse amestecuri de biocombustibil a rezultat o evoluție prezentată în figura 1.

Se poate ușor observa că emisia de CO (care se formează la arderea incompletă a amestecului de carburant în camera de ardere a motorului) se micșorează odată cu creșterea sarcinii. La funcționarea motorului cu biocombustibil pur

(B100) se asigură o micșorare a emisiei de CO până la o sarcină de 75% Pe.

Pentru diverse sarcini ale motorului (0; 25%; 50%; 75%), folosind toate tipurile de combustibili precizați, se poate constata o creștere importantă a emisiei de CO_2 (figura 2).

Creșterea este cu atât mai importantă cu cât se reduce proporția de motorină din amestecul utilizat. Deși emisia de CO_2 nu se clasifică drept emisie poluantă nocivă, influențează într-o mare măsură „efectul de seră", fenomen legat de schimbarea climei.

În cadrul cercetărilor experimentale efectuate s-a studiat și emisia de C_nH_m la folosirea diverselor amestecuri de combustibil, la sarcini diferite.

Rezultatele obținute ne demonstrează că la utilizarea biocombustibilului pur arderea este mai bună în comparație cu alte tipuri de combustibil studiate și asigură o micșorare mai mare a emisiei de hidrocarburi la o sarcină de 50% Pe.

4. CONCLUZII

1. Utilizarea carburanților alternativi contribuie la protejarea mediului prin reducerea emisiilor de C_nH_m, CO, având un impact ecologic pozitiv;
2. În cadrul încercărilor efectuate s-a constatat că impactul ecologic este mai redus în cazul utilizării biocombustibilului comparativ cu folosirea motorinei (100%) ;
3. Metodologia prezentată în acest studiu de evaluare a emisiilor poluante la utilizarea drept combustibil a biocombustibililor și a unor amestecuri (în proporții diferite) de motorină și biocombustibil este adecvată scopurilor propuse și evidențiază avantajele folosirii biocombustibililor;
4. Folosirea biocombustibilului la alimentarea motoarelor cu aprindere prin comprimare prezintă în primul rând avantajul reducerii emisiilor poluante, dar și pe acela a unui conținut mai redus de sulf, cu influențe importante în creșterea duratei de utilizare a motoarelor.

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UN NOU PROIECT SIAR-RAR
NEW SIAR-RAR PROJECT

Colaborarea fructuoasă dintre Societatea Inginerilor de Automobile din România și Registrul Auto Român a înregistrat, după organizarea primei ediții a Universității de Vară în Ingineria Autovehiculelor – UNIvIA 2017 împreună cu Academia Tehnică Militară din București, o nouă etapă pe durata Congresului Internațional de Inginerie a Autovehiculelor și Transporturilor Rutiere CAR 2017 – desfășurat în perioada 08 – 10.11.2017 la Universitatea din Pitești.

Diseminarea în rândul inginerilor de automobile a ultimelor preocupări și realizări din domeniul ingineriei autovehiculelor și transporturilor rutiere pe diverse teme de interes la nivel mondial constituie atât o preocupare, cât și o necesitate identificată de cele două organizații, determinând acțiuni comune și proiecte pe termen lung.

La invitația Comitetului de organizare a Congresului CAR 2017, ca parte a colaborării active , amplificate, cu SIAR, Registrul Auto Român a deplasat și prezentat participanților la CAR unul dintre laboratoarele mobile utilizate în cadrul programului *PEMS - Portable Emissions Measurement Systems,* împreună cu o echipă entuziastă de specialiști condusă de ing. Tiberiu MELENCU. Primită cu interes deosebit, implicarea RAR în această temă de actualitate a găsit un cadru adecvat de prezentare în cadrul work-shop-ului *„Real Driving Emissions via Portable Emissions Measurement Systems",* organizat în data de 09.11.2017.

Dar, impactul semnificativ, atmosfera participativă, comunicarea liberă, profundă, dar și neconvențională, au fost înregistrate la întâlnirea echipei RAR cu studenții participanți la Concursul Internațional Studențesc de Inginerie a Autovehiculelor „Prof. univ. ing. Constantin Ghiulai" (49 studenți din 12 universități din România și Republica Moldova participanți la cele două secțiuni ale concursului „Dinamica autovehiculelor" (la a patra ediție) și „Automotive CAD – CATIA V5" (la prima ediție), cărora li s-a alăturat un număr semnificativ de studenți din domeniul „Ingineriei autovehiculelor" și „Ingineriei Transporturilor" din universitatea gazdă.

Atât conferința prezentată în fața studenților, cât și dialogul dintre studenți și specialiștii RAR, derulate într-o atmosferă călduroasă, apropiată și prietenoasă, precum și exemplificările practice făcute lângă echipamentul dispus în expoziția tematică organizată cu prilejul CAR 2017 au oferit prilejul unui schimb intens, calificat și util de informații și soluții specifice temei abordate.

Succesul înregistrat de activitatea derulată pe această temă îndreptățește proiecția unei colaborări mai pronunțate SIAR - RAR în conceperea, dezvoltarea și punerea în practică la un nivel mai înalt de noi proiecte în decursul anului 2018, inclusiv pe perioada AMMA 2018!

Prof. dr. ing. Minu Mitrea
Secretar General SIAR

ASYMMETRIC ENCRYPTION FOR THE AUTONOMOUS VEHICLE

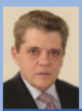
CRIPTARE ASIMETRICĂ PENTRU AUTOVEHICULELE AUTONOME

ABSTRACT

The future of the vehicle is of cars, roads and infrastructures connected in a two way automated communication in an holistic system. It is a mandatory to use Encryption to maintain Confidentiality, Integrity and Availability in an ad hoc vehicle network. Topology of the network produces its structure and key distribution. Both Star and ad hoc (Manet) topologies wereinvestigated as a solution for autonomous/smart vehicle system. As a conclusion a combined topology was developed, as the nature of the vehicle and infrastructure allows combined solution, that benefits from both topologies advantages, with low number of Keys, real time performance of the Vehicle to Vehicle (V2V) and strong reliable encryption on the Infrastructure to Vehicle (I2V) as well as easy integration of old (dumb) vehicles.

Key-Words: *Connected car, asymmetric encryption, key exchange, real time communication.*

Drd. ing.
Ron DAVIDESCU[1]
rondavidescu@gmail.com



Prof. dr. ing.
Eugen NEGRUȘ[2]

1. SATEC Ltd., 91450 Jerusalem, Israel
2. Politehnica University of Bucharest, Splaiul Independenței, Nr. 313, Bucharest, România

1. INTRODUCTION

Not too long ago, security of automotive was equal with theft prevention. However as computerization in the modern vehicle is growing quickly to enable the implementation of autonomous driving and the connected car, safety has become synonymous with security. It is clear that the autonomous car is unique in the requirement for operation with zero tolerance for failure in availability, continuity and security. Farther more current demonstrations by research groups have proven that vehicles can be penetrated remotely through their communication units and ordered to run malicious code that permits the intruder to control remotely the vehicle. Therefore, it has been confirmed that automobiles breaches in security already have severe safety effects. As safety is always the primary concern of every car manufacturer, automobile manufacturers must make security the same priority as safety. As automobiles open to peripheral networks, they become potential targets of malicious hackers. New embedded computers and external communication interfaces create even more treats and bring new attack surfaces. Communication interfaces not only suffer from classical IT weaknesses but from the fact that vehicles by nature have to rely on wireless communication with no wired back up. One of the clear difficulties in massive implementation of the connected car are the opposite demands of strong, reliable, encryption and description while keeping real time operation in a moving vehicle with low computer resource environment. It is known that a key advantage of Asymmetric Encryption over Symmetric Encryption is that no secret channel is required for the transfer of the public key. Furthermore the benefit of simple key management in asymmetric encryption in V2I (Vehicle to Infrastructure) and even more in V2V (Vehicle to Vehicle) communication allowed us to develop and demonstrate through software simulation, an holistic model of multilevel authorization in communication, even in the case of ad hock V2V network. Multilevel authorization network is guaranteed in the V2I communication, expanding it to the V2V case allows stronger read and write permits for a part of the fleet, for example emergency and security vehicles.

2. VEHICULAR COMMUNICATION INFRASTRUCTURE TOPOLOGY

In the near future the majority of new automobiles will be equipped with two way radio systems for car to car and car to Infrastructure communication. A comparison between the Vehicle and Infrastructure of computer and connectivity foundations (Table 1), shows a contradiction between the demands to capability of the vehicles and infrastructure. Vehicles by nature are mobile, require real time multi party wireless communication with limited computer communication and bandwidth access on the other hand infrastructure is on a fixed location, backed up by wired communication with almost unlimited computer, memory and back up availability. Furthermore wireless towers are by design redundancy.

Heading level	Vehicle	Infrastructure
Location	Mobile	Fixed
Computer power	Low	High
Communication	Wireless	Wired/Fast - I2I Wireless I2V, V2I
Memory	Low/Limited	Large/expandable
Band width	Low	High
Back up	Local/limited	Large/Cloud
Availability	Part time	Always On

Table 1. Vehicle vs. Infrastructure: computer and connectivity foundations

The wireless network topology structure is defined from the functionality required by the different parties. By nature I2V and V2I is of a central address (Infrastructure) that communicates with multi parties (Vehicles), in other words star network topology. In this topology all components connect to a central Infrastructure. The vehicles are not linked to each other and it does not allow direct traffic between devices. The active star network has an active Infrastructure central node that usually has the means to prevent security problems.

Star topology advantages Easy to diagnose network fault, Good performance, Scalable, easy to set up and to extend on the other hand, Star topology main disadvantage is that it totally depend on a single hub. On the other hand V2V, requires multi channel interaction between mobile, moving and changing parties to insure the full benefit from data sharing and real time decision making, a network of such users referred as mobile ad hoc network (MANET) [A survey of secure Mobile AD HOC. A Mobile Ad-hoc Wireless Network (MANET) is a collection of autonomous nodes that communicate with each other by forming a multi-hop network, maintaining connectivity in a decentralized manner.

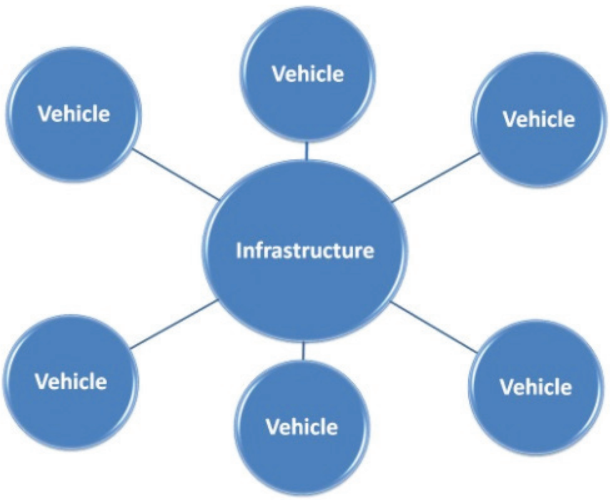


Fig. 1. Star topology (Source: Nivedita Bisht , p.1)

It consists of a set of mobile hosts communicating amongst themselves using wireless links, without the use of any other communication support facilities, such as base-stations. The nodes in a MANET can be any device that is capable of transmitting and receiving information. Each node in such a network acts as a host or end system (transmitting and receiving data) and simultaneously as a router. The nodes in a MANET are generally mobile and may go out of range of other nodes in the network [2].

3. AD HOC NETWORK PERFORMANCE SIMULATION

In order to evaluate the performance of Ad Hoc networks in a changing conditions a simulation of different Ad Hoc protocols was performed on multiple number of mobile nodes. We have examined three common routing protocols for MANET. DSDV is a proactive protocol, every mobile station maintains a routing table with all available destinations along with information like next hop, the number of hops to reach to the destination, sequence number of the destination originated by the destination node, etc. DSDV uses both periodic and triggered routing updates to maintain table consistency. Triggered routing updates are used when network topology changes are detected, so that routing information is propagated as quickly as possible [3]. DSR is a reactive routing protocol which allows nodes in the MANET to dynamically discover a source route across multiple network hops to any destination. In this protocol, the mobile nodes are required to maintain route caches or the known routes. The route cache is updated when any new route is known for a particular entry in the route cache. AODV is a reactive routing protocol instead of being proactive. It minimizes the number of broadcasts by creating routes based on demand, which is not the case for DSDV. When any source node wants to send a packet to a destination, it broadcasts a route request (RREQ) packet. The neighboring nodes in turn broadcast the packet to their neighbors and the process continues until the packet reaches the destination [2]. For the simulation of the developed system ViSim 1.0 has been used, ViSim calls ns-2 simulations in a Windows environment, to allow rapid configuration for any MANET routing scenario [2].

Define options

set val(chan)	Channel/WirelessChannel	;# channel type
set val(prop)	Propagation/TwoRayGround	;# radio-propagation model
set val(netif)	Phy/WirelessPhy ;	# network interface type
set val(mac)	Mac/802_11 ;	# MAC type
set val(ifq)	Queue/DropTail/PriQueue ;	# interface queue type
set val(ll)	LL ;	# link layer type
set val(ant)	Antenna/OmniAntenna	;# antenna model

Table 2. Simulation Parameters

set val(ifqlen)	50	;# max packet in ifq
set val(nn)	20/40/60/80/100	;# number of mobilenodes
set val(rp)	DSR/AODV/DSDV	;# routing protocol
set val(x)	2000	;# X dimension of topography
set val(y)	1000	;# Y dimension of topography
set val(stop)	150	;# time of simulation end

All three protocols were compared in a 20,40,60,80 and 100 mobile nodes in random four traffic lanes as can be seen in Figure 2. The following performance metrics were evaluated to understand the behaviour of DSDV,DSR and AODV, Max throughput, Goodput (In terms of Packet Size in Bytes), Routing Load (In terms of Bytes).

Max Throughput is the max bytes received by the destination node per second (Data packets and Overhead).

Routing Load (in terms of Packet Size in Bytes) is the ratio of the total bytes of routing packets that are sent within the network to the total number of bytes that are transmitted within the network to reach the destination.

Goodput (In terms of Packet Size in Bytes) is the ratio of the total bytes of data that are sent from the source to the total bytes that are transmitted within the network to reach the destination.

It is clear that in terms of performance of throughput and routing load DSR protocol has a clear advantage, and even in the Goodput parameter is similar to the AODV and DSDV protocols in the high node number mode.

4. HYBRID NETWORK ASYMMETRIC ENCRYPTION

The most important challenge that MANET is facing is the security issue. Some of the issues that cause that is that there is no centralized administration control, that the wireless channel is unprotected [4].

However in the case of connected / autonomous vehicles most of the weakness of a classic ad hoc network can be migrated due to the hybrid nature of the network that allows V2I

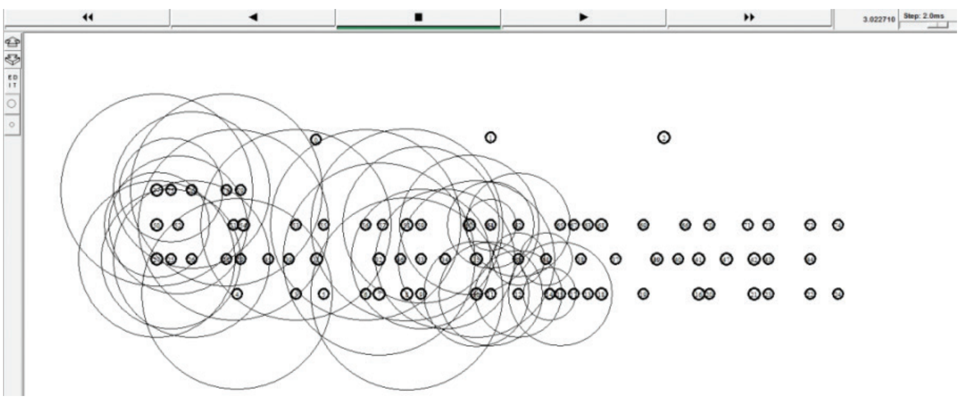


Fig. 2. AD hoc network (Source: Simulation results [2])

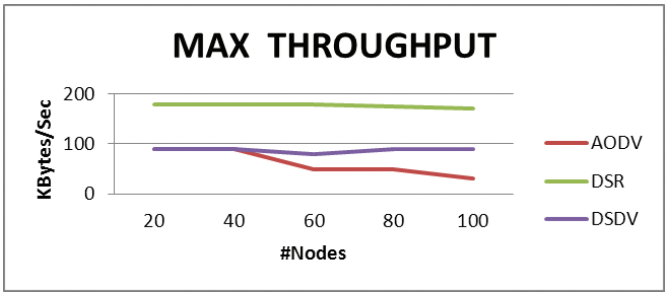


Fig. 3. MAX Throughput results (Simulation results)

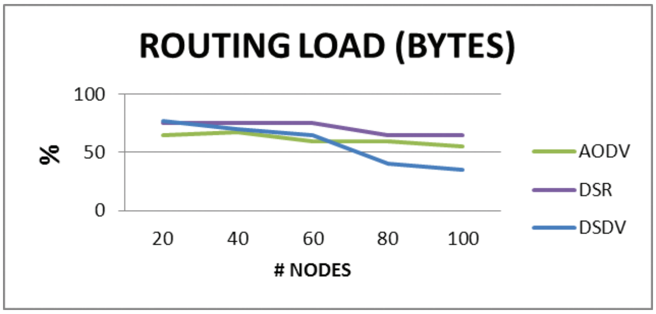


Fig. 4. Routing Load results – Bytes (Simulation results)

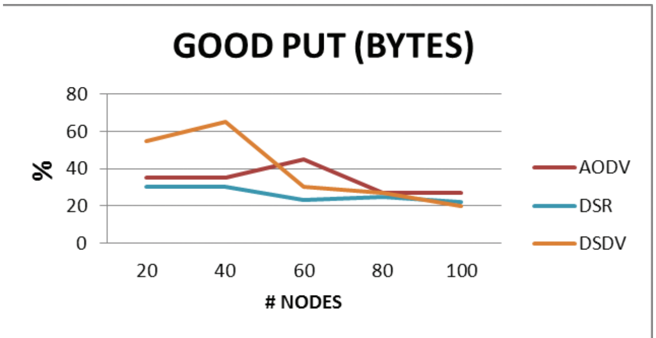


Fig. 5. Goodput results – Bytes (Simulation results)

$$
\begin{aligned}
A &\rightarrow * &:& \quad \{\mathrm{RDP}, X, N_A\}_{K_{A-}}, [cert_A] \\
B &\rightarrow * &:& \quad \{\{\mathrm{RDP}, X, N_A\}_{K_{A-}}\}_{K_{B-}}, [cert_A, cert_B] \\
C &\rightarrow * &:& \quad \{\{\mathrm{RDP}, X, N_A\}_{K_{A-}}\}_{K_{C-}}, [cert_A, cert_C] \\
X &\rightarrow C &:& \quad \{\mathrm{REP}, A, N_A\}_{K_{X-}}, [cert_X] \\
C &\rightarrow B &:& \quad \{\{\mathrm{REP}, A, N_A\}_{K_{X-}}\}_{K_{C-}}, [cert_X, cert_C] \\
B &\rightarrow A &:& \quad \{\{\mathrm{REP}, A, N_A\}_{K_{X-}}\}_{K_{B-}}, [cert_X, cert_B]
\end{aligned}
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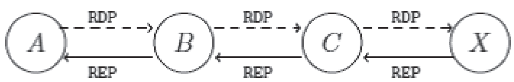

Fig. 6. The ARAN protocol (an example with four nodes-Simulation results) (Source Benetti p2 [6])

and I2V is a trusted secure star topology and V2V in an ad hoc model. ARAN [5] or Authenticated Routing for Ad hoc Networks detects and protects against malicious actions by third parties and peers in an ad hoc environment. ARAN introduces authentication, message integrity, and non-repudiation. It is composed of two distinct stages. ARAN makes use of cryptographic certificates for the purposes of authentication and non-repudiation. Stage 1 contains a preliminary certification stage and a mandatory end to end authentication stage. ARAN requires the use of a trusted certificate server T. Before entering the ad hoc network, each node requests a certificate from the trusted server. The certificate contains the IP address IPA of the node, the public key of the node, a timestamp, of when the certificate was created, and a time at which the certificate expires. These variables are concatenated and signed by the trusted server. All nodes must maintain fresh certificates with the trusted server and must know the trusted server public key. The goal of Stage 1 is for the source to verify that the intended destination was reached. In this stage, the source trusts the destination to choose the return path. Stage 2 is performed only after Stage 1 has been successfully executed. This is because the destination certificate is required in Stage 2. This stage is primarily used for discovery of shortest path in a secure fashion. Since a path is already discovered in Stage 1, data transfer can be pipelined with Stage 2)'s shortest path discovery operation.

5.CONCLUSIONS

It is known that a key advantage of Asymmetric Encryption over Symmetric Encryption is that no secret channel is required for the transfer of the public key. Furthermore the benefit of simple key management in asymmetric encryption in V2I and even more in V2V communication allowed us to develop and demonstrate, an holistic model of Combined network topology, consist of Star topology for I2V communication, with strong encryption and ad hoc topology for V2V and V2I communication with ARAN topology encryption, therefore implementing multilevel encryption in an holistic system.

The combined topology model allows real time performance in V2V network due to with asymmetric encryption. Furthermore as Asymmetric encryption allows easy public key delivery to allow read permission for a 3rd party communication without compromising the network, the combined topology permits easy integration of older system including regular (dumb) vehicles that can benefit from the network knowledge through one way communication.

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SKILLS AND COMPETENCIES DEVELOPMENT FOR THE PROFESSIONALS OF THE FUTURE TRANSPORTATION SECTOR – THE SKILLFUL PROJECT

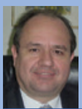
DEZVOLTAREA COMPETENȚELOR SPECIALIȘTILOR DIN TRANSPORTURILE VIITORULUI – PROIECTUL SKILLFUL

ABSTRACT

Industria transporturilor ocupă circa 4,5% din forța de muncă și reprezintă 4,6% din PIB. Această lucrare analizează cerințele care ar trebui îndeplinite prin formare și expertiză de specialiștii din domeniul transporturilor determinate de continua și dramatica dezvoltare tehnologică, mai ales de penetrarea in acest sector economic a sistemelor inteligente. În plus, această lucrare propune introducerea unor noi roluri în afacerile din sectorul transporturilor și mai ales în lanțul de educare și formare, care ar contribui la dezvoltarea și adaptarea competențelor la nivel european într-un mod durabil, în conformitate cu proiectul european SKILLFUL care urmărește realizarea unei viziuni structurate asupra calificărilor profesionale și academice din sectorul transportului viitorului, precum și sporirea capacității de angajare și a dezvoltării industriale durabile în sectorul transporturilor din Europa.

Key-Words: *ITS, automation, employability, transport professionals, skills, competences, future requirements, training tools, lifelong training.*

Dr.
Matina LOUKEA[1]
mloukea@certh.gr



Dr. ing.
Evangelos BEKIARIS[1]

Dr. ing.
Maria PANOU[1]

Dr. ing.
Thierry GOGER[2]

Dr. Ing.
Adewole ADESIYUN[2]

1 Center for Research and Technology Hellas - Hellenic Institute of Transport (CERTH - HIT), Thessaloniki, Grecia
2 Forum des Laboratoires Nationaux Europeens de Recherche Routiere (FEHRL) - Brussels, Belgia

1. INTRODUCTION

The transport industry of Europe employs over 10 million people representing the 4.5% of total employment, as well as the 4.6% of the Gross Domestic Product (GDP) [1]. This fact, combined with the continuous technological developments and the ongoing growth of the transport sector, increases the need for seamless education, training and qualification improvement of professionals in this sector. National and regional authorities have traditionally been responsible for the development and evolution of the educational standards, curricula, training tools and methods addressing mainly the needs of national and regional labour-markets. Nevertheless, during the last years a trend concerning the globalization of the transport professionals' competences has been witnessed, regarding though mainly fields with a more international range of cooperation, such as ITS [2]. The European Commission places great importance on the role of academic and vocational qualifications having a direct impact on employability [3] and this is also a crucial element of the Europe 2020 strategy. The Bologna Process [4] and Lisbon Strategy [5] in Europe are, among others, the clearest examples of international engagement, for more comparable, compatible and coherent systems of higher education, as well as for the development of a dynamic and competitive knowledge-based economy in Europe. Given this, some international initiatives have already been developed for educational and vocational programmes regarding transport professionals, such as joint University degrees based on cooperation between Universities from different countries. However we are still a long from even Europe-wide common qualifications and standards. Part of this effort is also the SKILLFUL project, whose vision is to analyse the emerging trends, to identify the skills and competences required by the Transport workforce of the future and define the training methods and tools to meet them. SKILLFUL will focus on employability for all transportation modes and for multimodal chains (which by themselves constitute a key transport of the future trend), as well as for all levels/types of workers (blue collar, white collar, managers, operators, researchers, etc.).

2. THE DEVELOPMENT OF ADVANCED TRANSPORT SYSTEMS AND THEIR IMPACT ON EMPLOYABILITY

The Intelligent Transport Systems and Services (ITS) make the transportation of people and goods more efficient, economical and thus smarter. They resulted from the combination of information and telematics technologies and their applications in the transport area and cover all modes of transport and all kinds of parameters associated with driving. Intelligent Transport Systems (ITS) can be used in order to make transport safer, more efficient and more sustainable, tackling Europe's growing emission and congestion problems for all modes of passenger and freight transportation. As the digitization of transport is moving forward, through the rapid development and evolution of the ITS sector, the European Commission is already working with Member States, industry and public authorities to find common solutions to the various barriers and difficulties that have already occurred and will occur in the future. The employability of the transportation sector is also directly affected by the development and deployment of intelligent systems. As these systems are establishing in all transportation areas, jobs in the sector are rapidly changing. For example, as the driver's cabin of a high-speed train becomes increasingly similar to an aircraft cockpit, train drivers are required to have additionally other skills than they used to, usually more advanced technical and analytical skills [6]. While the transport sector offers a wide variety of jobs with different skills requirements due to ongoing technological developments, in combination with social and economic trends, new pressures and needs are arising for highly skilled workers throughout the sector. The need of better and more specialized education and training becomes even more urgent considering also that the trend to automation features all employment sectors and continues to be driven by a corporate focus on cost competitiveness, outsourcing of engineering functions, thus increasing quality requirements and rising wage inflation across emerging markets [7]. According to the Oxford Martin Programme on the Impacts of Future Technology, nearly half of U.S. jobs could be susceptible to computerization over the next two decades and the jobs in transportation, logistics, and office/administrative support are at "high risk" of automation [8]. Thus, the issue of employment in the Transport sector is a major social phenomenon that affects the life of millions of people and requires sound and effective handling. This purpose and effort can be reinforced and promoted by the SKILLFUL project, through the development of new training/educational schemes, programs and tools taking under full consideration the existing needs but also those which will be derived in the future. On the expected innovation of the SKILLFUL project is the best practices and knowledge transfer in various technologies (i.e. in automation from air to road transport; in operator monitoring and vigilance support across all modes; in electrification from rail to maritime and road sectors, etc.) performed within the project wiith the focus on interdisciplinarity in automated maintenance application using extensively IT technologies.

3. ENHANCING EMPLOYABILITY OF THE TRANSPORTATION SECTOR OF THE FUTURE

3.1. Future trends in transport systems and their job impact assessment

The development of the employment sector and its alignment with the current and future requirements is an issue of great importance for the EU. Providing people with the right skills for employment, as well as matching these skills with the labour market requirements remains a challenge [9]. For the above purpose to be achieved, emphasis needs to be given to the intelligent transport systems and services (ITS) and supporting technologies which have been developed to such an extent that they constitute an integral part of the transport sector. Advances in the Internet of Things (IoT), Networking and Connected Car technologies are transforming almost its overall context. For the promotion and further development of the transport sector proper education and training of professionals is required, in order to be able to cope with the introduction of new technologies and automation in all transport areas and modes. Proper education and training is also essential for safety reasons as the incorrect use of such systems or the misuse of technologies of this kind by professionals not adequately qualified may lead to accidents or even to loss of lives. During the SKILLFUL project, the most critical emerging technologies will be identified and analysed, in order for the connections between those technologies and future employment demands to be determined. Among the key technologies that are going to be analysed are the following:

- Information technologies and telematic applications.
- Cooperative Systems and V2X interfaces.
- Radars, lidars, machine vision and innovations in object recognition.
- Traffic big data handling methods.
- Pro-active traffic and incident management algorithms.
- Gamification concepts.
- Affective and Persuasive interfaces.
- Augmented Reality interfaces.
- New materials and processes.
- Logistic tracing and tracking.

Additionally, as the Transportation sector moves steadily from products to services, emphasis will also be devoted in the identification of relevant emerging novel service concepts and bundles. The most important service concepts will be recognized, as well as their impact to existing and emerging requirements of new jobs. Relevant key services and service concepts include:

- Mobility-as-a service (MaaS) enabling services (carpooling, carsharing, DRT and FMS schemes, etc.).
- Personalisation of services.
- Mobile services on the cloud.
- Context aware services.
- Support for on-the-fly decision making.
- Multimodal trip planners and routers.
- Payment mechanisms to facilitate easy transfers across different modes.
- Integration of social media into Public Transport.
- Novel tourism/recreational services, incorporating travel and mobility services.
- Integration of infrastructure-based and in-vehicle services.

Even more than technologies, new business schemes that accompany them will change the working ecosystem of transport. So, MaaS will push users from ownership to usership; thus creating a number of connected jobs and business opportunities to it. As major relevant business schemes the following ones are going to be analysed:

- Do-It-Yourself (DIY) schemes that changed the home furniture area some decades ago and are now migrating to the choice of vehicle and infomobility services sectors.
- Crowdfunding schemes that allow new transport related applications to emerge.
- Transport on demand schemes that adapt flexibly to the kind and number of objects to be transported.
- Fuel availability schemes that offer energy for transport vehicles available at the concrete time and the distinct localization.
- Retail and (e)commerce development.
- Transport workplace flexibility.
- Transport workforce flexicurity.

The identification, designation and analysis of all these technologies, services and business schemes is going to be the first and most crucial step that will trigger the procedures for the determination of required qualifications and competences for the future professionals of the transportation sector. During the SKILLFUL project these skills and competences are going to be prioritised, as well as gaps in the current and foreseen levels are going to be identified, in order to lay the foundations that will lead to the development of appropriate educational/ vocational system and program, accompanied by the relevant curricula, tools and methods. This whole procedure will, of course, take under consideration the current educational and training systems for workers in the transport sector (all modes).

3.2. The introduction of new business roles in the future transportation sector

Another factor that could contribute to the development and evolution of the future employability in the transport sector and which is a key element and objective of the SKILLFUL project is the creation of new business roles that will cover some of the new needs emerging by the overall change in the field of education and training of transport professionals.

Some of these roles are the following:

• **"Knowledge aggregators"**: The technological advancements are so rapid that traditional players (i.e. VET organization and Universities, let alone Transport infrastructure or fleet operators) can't follow them. On the other hand, Research Centers and performers that possess the relevant knowledge do not focus so much on training; especially as low to middle level skilled personnel is concerned. "Knowledge aggregators", may thus be established as coalitions, spin-offs or other collaboration schemes between Research Institutes and Transport Associations or Universities/VET operators; to cover this need and become the Centers of Excellence on developing training material, tools and curricula, training the trainers and certifying the training processes.

• **"Training promoters"**: The need for the appropriate training to be continuous and make use of advanced tools (primarily ICT related, but also simulation ones) leads to a procedure that is more and more costly. And although "it pays off on the long run", it may be difficult to be financially supported by individual SME's or other entrepreneurs in the transport sector. Thus, alternative schemes may be established, utilizing existing or emerging stakeholders Associations but also PPP's, in order to promote, guide and co-finance the necessary training schemes.

• **"Training certifiers"**: New courses and trainee/trainer competences need to be certified and accredited correspondingly at a Pan-European scale. In such a context, methodologies and policies should be implemented, in order to reach excellence and quality in education provision and harmonization throughout EU countries. Along with trainee requirement and trainer competences, trainer and education providers would meet criteria for excellence through accreditation or other attests, agreements or certifications. A higher education institution at the EU level (similar to the European Consortium for Accreditation in Higher Education, ECA) may be mandated to assess requirements fulfilment and recognition of accreditation decisions.

The definition and analysis of new actor roles, such as ones described above may dramatically change the future training provision and become the catalyst for its sustainability.

4. CONCLUSION

Europe, potentially, will face a major skills problem in the near future. Over 20 million new jobs are expected to be created between 2006 and 2020. Expansion of high- and medium level skilled occupations is expected to continue over the next decade, while an increase is also anticipated for some jobs requiring lower level skills, like jobs that consist of simple and routine tasks and require basic education to carry them out [10]. The current paper deals with this important issue directly related to the sustainability of the transport sector, such as the proper and continuous education and training of its component members, so that they can meet the new and constantly alternating needs of the transport sector that are mainly deriving by the development of technology and of intelligent transport systems and services. The SKILLFUL project is a new project which aims to utilize existing and emerging training/education methodologies, tools and knowledge, to design novel training/education schemes and pilot several of them, in order to prove their usefulness and assess their impact. SKILLFUL will also propose best practices, training application guidelines and policy recommendations to promote the novel training/learning schemes and their Europewide adoption.

ACKNOWLEDGEMENT

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professionals at all levels", under the Horizon 2020 Work Programme 2016-17 "Smart, green and integrated transport" and specifically the call topic "MG.8.3-2016: Assessing future requirements for skills and jobs across transport modes and systems".

Lucrare prezentată în cadrul Congresului Internațional de Inginerie a Autovehiculelor și Transporturilor - CONAT 2016, 25.10 – 27.10.2016, Brașov, România, și publicată în Proceedings of the Congress (ISSN 2069-0401).

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DEVELOPMENT OF A SEAT HEATING SYSTEM WITH FAR – INFRARED RADIATION

DEZVOLTAREA UNUI SISTEM DE ÎNCĂLZIRE A SCAUNELOR FOLOSIND RADIAŢII INFRAROŞII

ABSTRACT

The thermal comfort sensation is assured by the factors that depend on the heat exchange between the human body and the ambient environment. This paper presents the development of a seat heating system for automotive with infrared radiation which offers an improved human thermal comfort. The proposed solution uses a heating kit that includes a few materials and the heat source is a radiant foil based on far-infrared radiant heat which gives a longer heating effect than other heating systems. In this paper will be analyzed the temperatures in different points on the automotive seat measured on the experimental way both for the heating system with infrared radiation, as well as the system using the electrical resistance, knowing that both systems develop the same power.

Key-Words: *Seat heating system, infrared radiation, thermal comfort, automotive*

Conf. dr. ing.
Mariana IVĂNESCU[1]
mariana.ivanescu@upit.ro

Conf. dr. ing.
Ionel VIERU[1]

Dr. ing.
Cătălin NEACŞU[2]

Conf. dr. ing.
Florin ŞERBAN[1]

Prof. dr. ing.
Ion TABACU[1]

1 Universiatatea din Piteşti, Str. Târgul din Vale, Nr. 1, 110040 Piteşti, Romania
2 SC Automotive Dacia SA, 115400 Mioveni, Romania

1.INTRODUCTION

The thermal comfort sensation is assured by the factors that depend on the heat exchange between the human body and the ambient environment. This paper presents the development of a seat heating system for automotive with infrared radiation which offers an improved human thermal comfort. Most of the heating systems for the automotive seats use electrical resistance and the heat is transmitted to the human body only by conduction. In relation to international state of the art there are a lot of researches concerning car seat heaters which use electric resistance, carbon fiber and infrared way for improvement of the thermal comfort. Car heating systems integrated into the seat or in the passenger compartment have been the source of different brevets. The chosen solutions include the integration of a thin carbon fiber layer on the seat foam, powered by the vehicle battery [1] or integration of a resistive wire in the foam support [2]. Also in the DE102007039423 A1 [3] patent is presented a heating device for vehicle seat of motor vehicle, particularly open passenger car, has heating element, by which body area, particularly head, shoulder and neck area of seat passenger are heated. To improvement human thermal comfort inside the passenger compartment one other solution include an infrared heating device for warming upper body of e.g. driver of passenger car, has heat radiator arranged at rear side of mirror element of inner mirror i.e. inner rearview mirror, where mirror element comprises reflecting surface [4].

2.DEVELOPMENT OF SEAT INFRARED HEATING

2.1.About the infrared heating

The proposed solution uses a heating kit that includes a few materials and the heat source is a radiant foil based on far-infrared radiant heat which gives a longer heating effect than other heating systems. The infrared radiant heat flux transferred to human body is transmitted by electromagnetic wave [5]. Far-infrared ray and anion are known to effectively suppress odors and growth of germs and boost the metabolism of the human body, not to mention the fact that they provide a healthier environment. The first advantage of the infrared heating system in comparison with classical system is the uniform heat flux transmitted to surface of the human body and the second advantage is that this solution offers different temperatures, especially in the lumbar area resulting a rapid achievement of thermal comfort.

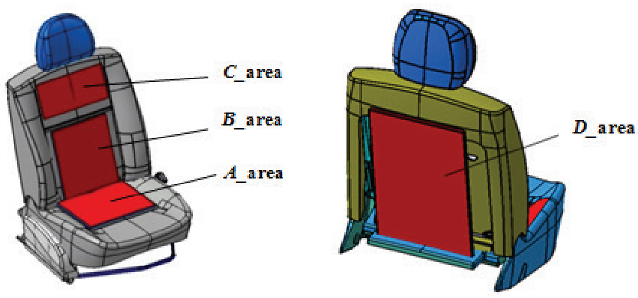

Fig. 1. Infrared kits placement on four areas of the seat

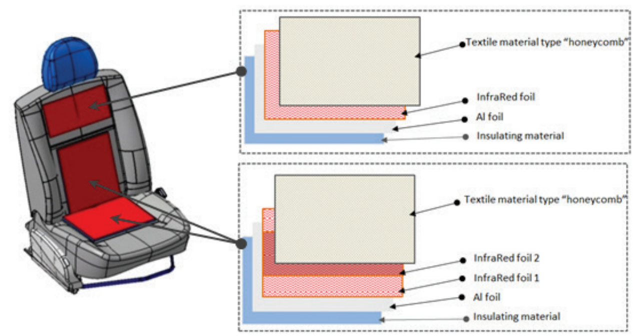

Fig. 2. Infrared kits placement and their components

2.2.Integration of the IR kits on seats

The developed solution propose the use of heating kits which are placed on four areas of the seat (A, B, C, D areas), as seen in Figure 1 [6,7].

When using the classic seat heating system is difficult to obtain a optimal temperature for the rear passengers in a short time. By putting the heating kit in the D area, we obtain a increase in thermal confort for rear seat passengers. To reduce the transmission of heat flux to the seat foam, the kits are composed from the following layers of material: honeycomb type textile material used as seat cover/ infrared foil/aluminum foil/ thermal

Fig. 3. Electric resistance heater

Fig. 4. Infrared heater

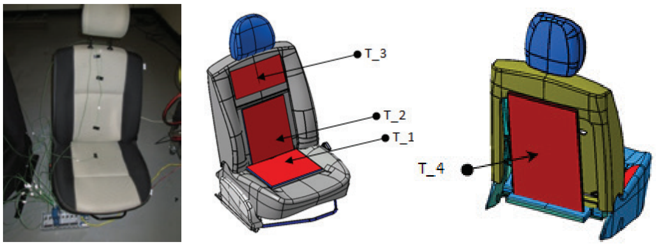

Fig. 5. Thermocouples placement on the seat cover

insulating material (Figure 2).

To optimize the electrical energy consumption, the system is started/ stopped manually, using two switches: one for A, B and C areas (called S_1), and the other for the D area, needed to increase the thermal comfort for the rear seat passengers (called S_2). Also, to obtain an optimal thermal comfort and thermal protection of the system, both systems are equipped with thermostats: a 45°C thermostat with S_1, and for the S_2 a 50°C thermostat.

3.EXPERIMENTAL RESULTS

In this paper the experimental researches and results were obtained in a laboratory environment and have completed two distinct stages. In the first part will be analyzed the temperature variation measured on the experimental way both for the heating system with infrared radiation, as well as the system using the electrical resistance and the heat flux is transmitted to environment. In the second part will be measured the temperatures values in different points on the automotive seat measured on the experimental way for the new heating system with far infrared radiation and the heat flux is transmitted to human body [6].

3.1Experimental setup

To be able to compare from experimental point of view the results obtained with both heating systems (electric resistance heater vs. infrared heater) we will develop an infrared foil heater that develop the same power as the electrical resistance heater.

In Figures 3 and 4 are presented the placement of both systems to be able to visualize the heat flux transmission to the environment and the temperature variation in time.

The physical parameters for both systems (electrical current, voltage and system power) are presented in Table 1.

To determine the infrared heating system performance we must measure the temperatures between seat cover and human body, such as the temperature value on the D_area surface. The data acquisition is realized with the NI DAQ - 9188XT system using K type thermocouples, placed on the seat cover as seen in Figure 5.

Table 1. The physical parameters corresponding heating systems

Physical parameters:	Electrical resistance system	Infrared foil system	
		S_1 system	*S_2 system*
Electrical current [A]	5.8 A	5,8 A	5.9 A
Voltage [V]	14,5 V	14,5 V	14,5
System power [W]	84.1 W	84.1 W	85.5 W

Table 2. Temperature values for the both heating system

Time[s]	T_res[°C]	ΔT_res[°C]	T_foil_IR[°C]	ΔT_foil_IR[°C]	ΔT[°C]
0	19.3	0	19.3	0	0
60	19.9	0.6	22.6	3.3	2.7
120	21.8	2.5	26.1	6.8	4.3
180	23.3	4.0	28.6	9.3	5.3
240	24.5	5.2	30.5	11.2	6.0
300	25.8	6.5	31.9	12.6	6.1
360	26.4	7.1	33.0	13.7	6.6
420	27.1	7.8	33.7	14.4	6.6
480	27.6	8.3	34.6	15.3	7.0
540	27.8	8.5	35.2	15.9	7.4
600	28.3	9.0	35.5	16.2	7.2
900	29.6	10.3	36.9	17.6	7.3

3.2.Results

The experimental results obtained by comparing heating system with infrared foil and electric resistance system are presented in table 2 and under graph form in Figures 6 and 7 (T_res – the temperature of the electrical resistance system, T_IR foil - the temperature of the IR system, ΔT – temperature difference between the two systems).

In Figure 8 we can see the temperature values measured in three points on each seat and also the maximum temperature at seat level for both systems.

In the last part of this paper (Figure 9) is shown a graphic that depicts the temperature evolution during the experiment for a seat heated using the IR foil system. (T_1 – temperature on the textile material at the seating area – region A, T_2 – temperature on the textile material in lumbar area, T_3 - temperature on the textile material in cervical area, T_4 - temperature on the textile material zone D – according to Figure 5).

From the chart we can observe a rapid increase of the temperature on each area of the seat (A, B, C and D), as well as the temperature that is maintained constant after the entry into operation of the thermostat.

4.CONCLUSIONS

The advantages of using an IR seat heating system versus the electrical resistance system includes the following:

Due to use of a carbon structures electrically connected in parallel, we obtain a rapid and long-lasting heating, as compared to other heating systems. The heat flow is transmitted evenly on the human body from the first seconds of system operation, creating a sensation of thermal comfort much faster than electric resistance system. Using radiant foil overlaid layers allow temperature rise and also a controlled dispensing of

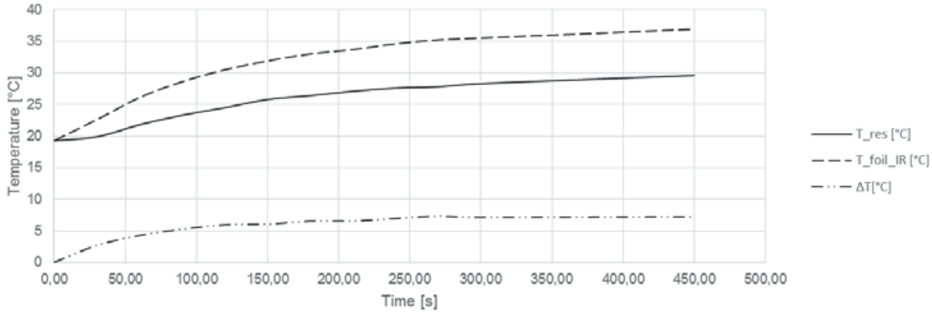

Fig. 6. The temperature variation for both systems

it depending on the physiological needs of passengers and conditions of use of motor vehicles. The advantage of the parallel connection of radiant foil is that in the case of interruption of electrical resistance, the system no longer working compared with radiant foil, which in case of withdrawal of an item, it continues to operate. The proposed systems offers an increased safety usage. The maximum temperature measured during functioning is 67,4°C for the IR foil compared with 90,8°C for electrical resistance system. On the other hand, in this solution, one of the heating kits is located on the seat backrest causing an improvement of the thermal comfort for the back passengers, especially in the leg area and abdominal area. Therefore, the heat propagation for this heating system is transmitted mainly by conduction, but also by radiation and convection. The electrical command of the system is independent for the backrest zone, to assure energy savings.

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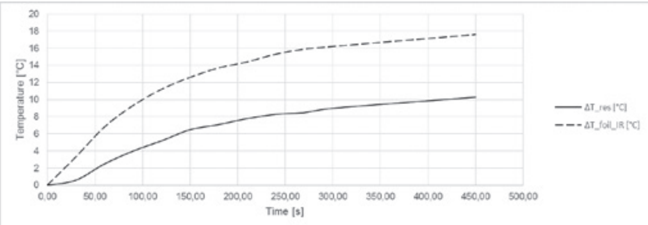

Fig. 7. The increase in temperature for both systems during the experiment

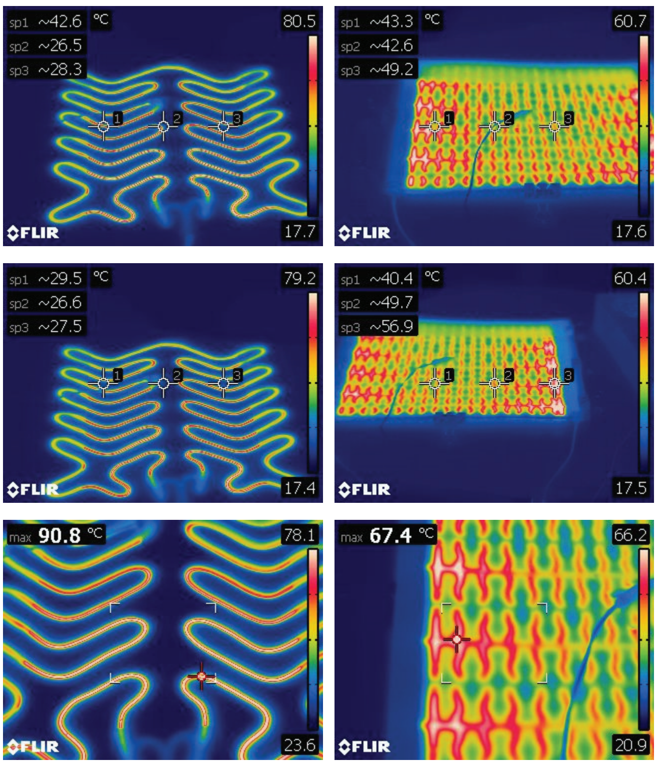

Fig. 8. The temperature values measured in three points

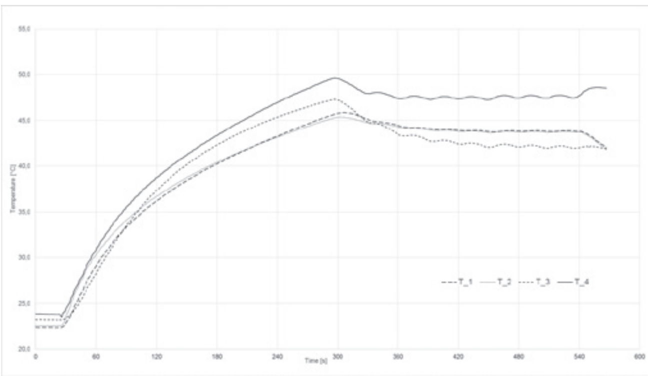

Fig. 9. Temperature evolution during the experiment for a seat heated using the IR foil system

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CONCURSUL INTERNAȚIONAL STUDENȚESC DE INGINERIE A AUTOVEHICULELOR „PROFESOR UNIVERSITAR INGINER CONSTANTIN GHIULAI”

Secțiunea „Automotive CAD – CATIA” – Ediția I-a

Secțiunea „Dinamica autovehiculelor” – Ediția a IV-a

THE INTERNATIONAL CONTEST FOR STUDENTS IN AUTOMOTIVE ENGINEERING „PROFESSOR ENG. CONSTANTIN GHIULAI”

The „Automotive CAD – CATIA V5” Section, First Edition

The „Automotive Dynamics” Section, Fourth Edition

Piteşti, 08.11. – 10.11.2017

În perioada 08.11 – 10.11.2017, pe durata ***Congresului Internațional de Inginerie a Autovehiculelor și Transporturilor CAR 2017***, organizat de către Societatea Inginerilor de Automobile din România la Universitatea din Pitești, au avut loc fazele finale ale ***Concursului internațional studențesc de inginerie a autovehiculelor „Prof. univ. ing. Constantin Ghiulai”*** la secțiunile *„Dinamica autovehiculelor”* și *„Automotive CAD – CATIA”* organizat, de asemenea, de SIAR.

La faza finală a celei de a patra ediții a secțiunii ***„Dinamica autovehiculelor”*** a concursului au participat 26 studenți reprezentând 10 universități: *Universitatea Tehnică din Cluj-Napoca, Universitatea din Craiova, Universitatea din Oradea, Universitatea din Pitești, Universitatea Politehnica din Timișoara, Universitatea „Transilvania” din Brașov, Universitatea Tehnică a Moldovei din Chișinău, Universitatea Agrară de Stat din Moldova – Chișinău, Universitatea „Ovidius” din Constanța și Academia Tehnică Militară din București*. Anterior, în toate aceste universități au fost organizate cu un succes deosebit competiții în cadrul fazei locale (pe universitate) a concursului la care au participat circa 250 de studenți la programele de studii universitate din domeniul „Ingineria autovehiculelor”. Câștigătorii concursurilor organizate în fiecare universitate au constituit echipele delegate pentru participarea la faza națională.

Pe baza rezultatelor obținute la faza finală a probelor de concurs, cu sprijinul AVL România, au fost acordate următoarele premii:

– Premiul I	– *Thomas Imre Cyrille BUIDIN – Universitatea Tehnică din Cluj-Napoca;*
– Premiul II	– *Doru CĂLIN - Academia Tehnică Militară din București;*
– Premiul III	– *Răzvan-Adrian FÎLDAN – Universitatea Tehnică din Cluj-Napoca;*
– Mențiune	– *Ana- Gabriela BADEA - Universitatea din Pitești.*

Echipa câştigătoare la secţiunea „Automotive CAD-CATIA

Pe echipe, clasamentul final stabilit pe baza rezultatelor obţinute de membrii echipelor a arătat astfel:

– Locul I – *echipa Universităţii Tehnice din Cluj-Napoca;*
– Locul II – *echipa Universităţii Transilvania din Braşov;*
– Locul III – *echipa Academiei Tehnice Militare din Bucureşti.*

Concursul a avut la bază o tematică şi bibliografie comune, elaborate de un grup de cadre didactice de specialitate, precum şi un regulament de organizare aprobat la nivel naţional.

Comisia naţională de concurs a fost constituită din Prof. dr. ing. Ion TABACU – Universitatea din Piteşti, coordonator naţional, Prof. dr. ing. Adriana MANEA – Universitatea „Ovidius" din Constanţa, Prof. dr. ing. Tiberiu MACARIE – Universitatea din Piteşti, coordonator tehnic, Prof. dr. ing. Ion PREDA – Universitatea „Transilvania" din Braşov, Conf. dr. ing. George DRAGOMIR – Universitatea din Oradea, Conf. dr. ing. Liviu MIHON – Universitatea Politehnica din Timişoara, Conf. dr. ing. Ioan-Adrian TODORUŢ - Universitatea Tehnică din Cluj-Napoca, S.l. dr. ing. Loreta SIMNICEANU – Universitatea din Craiova, Lector sup. univ. Petru VOLEAC – Universitatea Agrară de Stat din Moldova – Chişinău, Prof. dr. ing. Minu MITREA – Secretar general SIAR (iniţiator).

Prima ediţie a fazei finale a concursului la ***secţiunea „Automotive CAD - CATIA"*** a întrunit 23 studenţi reprezentând 8 universităţi: *Universitatea Tehnică din Cluj-Napoca, Universitatea Tehnică „Gheorghe Asachi" din Iaşi, Universitatea „Dunărea de Jos" din Galaţi, Universitatea din Piteşti, Universitatea Politehnica din Timişoara, Universitatea „Transilvania" din Braşov, Universitatea „Ovidius" din Constanţa şi Academia Tehnică Militară din Bucureşti*. Şi pentru această secţiune, anterior, au fost organizate în universităţi faze locale la care a participat circa 100 studenţi la programele de studii universitate din domeniul "Ingineria autovehiculelor". Dintre câştigătorii concursurilor organizate în fiecare universitate s-au constituit echipele de câte 3 studenţi, delegate pentru participarea la faza naţională.

Pe baza rezultatelor obţinute la probele de concurs, cu sprijinul S.C. Magic Engineering SRL din Braşov, au fost acordate următoarele premii:

– Locul I – *echipa Universităţii Tehnice „Gheorghe Asachi" din Iaşi:*
  - *Ionuţ OCNEANU*
  - *Valentin POPOVICI*
  - *Andrei RĂŢOI*

– Locul II – *echipa Academiei Tehnice Militare din Bucureşti:*
  - *Iulian Constantin COROPEŢCHI*
  - *Andrei Iulian INDREŞ*
  - *Alexandru VASILE*

– Locul III – *echipa Universităţii Politehnica din Timişoara:*
  - *Valentin BOROŞ*
  - *Claudiu ROTELIUC*
  - *Alexandru TIMIŞ*

Tematica, bibliografia şi regulamentul de organizare au fost elaborate de un grup de specialişti din cadrul Renault Technologie Roumanie, Magic Engineering, cadre didactice din universităţile participante şi Secretariatul General al SIAR.

Tematica etapei de calificare şi subiectele probelor de concurs au fost elaborate de colectivul de specialişti din cadrul RTR.

Comisia naţională de concurs a fost constituită din Prof. dr. ing. Dorin LELEA – Universitatea Politehnica din Timişoara, coordonator naţional, Conf. dr. ing. Ionel VIERU – Universitatea din Piteşti, coordonator tehnic, Conf. dr. ing. Virgil TEODOR – Universitatea „Dunărea de Jos" din Galaţi, S. l. dr. ing. Camil TUDOR - Universitatea „Ovidius" din Constanţa, S.l. dr. ing. Gabriel URSESCU - Universitatea Tehnică „Gheorghe Asachi" din Iaşi, S.l. dr. ing. Stelian TÂRULESCU – Universitatea „Transilvania" din Braşov, S.l. dr. ing. Emilian BORZA - Universitatea Tehnică din Cluj-Napoca, S.l. dr. ing. Radu VILĂU – Academia Tehnică Militară, Ing. Niculae BOICEA, Ing. Ciprian MARINESCU şi Ing. Sorin IŞTOC – RTR, Dr. ing. Benone COSTEA (iniţiator) şi ing. Atilla PAPP – Magic Engineering, Prof. dr. ing. Minu MITREA – Secretar general SIAR (iniţiator).

Buna desfăşurare a concursului a fost sprijinită de echipa Magic Engineering (Andreea OPREA, Alexandru STAN), iar la concurs şi la festivitatea de premiere a fost prezent reprezentantul Dassault Systemes în România – ing. Ion NICULAE .

Toţi studenţii participanţi au primit *Diplome de merit* pentru rezultatele deosebite obţinute la concurs.

Magic Engineering SRL Braşov a asigurat atât premiile consistente acordate câştigătorilor, cât şi licenţele CATIA V5 instalate pe calculatoarele din laboratorul destinat desfăşurării probelor de concurs.

Concursul internaţional studenţesc de inginerie a autovehiculelor „Prof. univ. ing. Constantin GHIULAI" a beneficiat de suportul logistic consistent asigurat de Departamentul de Autovehicule şi Transporturi din Facultatea de Mecanică şi Tehnologie a Universităţii din Piteşti (inclusiv masa şi cazarea studenţilor).

Societatea Inginerilor de Automobile din România – SIAR va organiza următoarea ediţie a Concursului internaţional studenţesc de inginerie a autovehiculelor „Prof. univ. ing. Constantin Ghiulai", cu secţiunile "Dinamica autovehiculelor" şi „Automotive CAD – CATIA V5", în perioada 17 – 19 octombrie 2018, simultan cu al XXIX-lea Congres Internaţional al SIAR de Inginerie a Autovehiculelor găzduit de Universitatea Tehnică din Cluj-Napoca drept a IV-a ediţie **„AMMA 2018** - ***Automotive, Mobility, Modeling and Alternative solutions***".

Pentru detalii suplimentare, vă rugăm să accesaţi
http://siar.ro/siar-junior/

Prof. univ. dr. ing. Minu MITREA
Secretar General SIAR

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17 – 19 Octomber 2017, Cluj-Napoca, Romania

Congress Subject: AUTOMOTIVE ENGINEERING AND ENVIRONMENT

Congress Themes:

1. ***Hybrid and electric vehicles***
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Author registration opened	June 1, 2017
Author registration closed	July 31, 2018
Call for Papers posted	January 1, 2018
Submissions accepted	January 10, 2018
Submissions closed	July 1, 2018
Reviews	
Reviewer registration opened	January 1, 2018
Reviewer registration closed	June 1, 2018
Website Posting	
Accepted abstracts	June 25, 2017
Schedule (included in Conference Information listing)	June 25, 2017
Accepted papers	June 25, 2017
Delay open access until	June 25, 2017
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