Faculty of Engineering

Ministry of Education,
Science and Technological Development

9th International Congress

Motor Vehicles & Motors 2022

ECOLOGY - VEHICLE AND ROAD SAFETY - EFFICIENCY

Book of abstracts

University of Kragujevac

Department for Motor Vehicles and Motors

International Journal for Vehicle Mechanics, Engines and Transportation Systems

October 13th - 14th, 2022
Kragujevac, Serbia

9th International Congress
Motor Vehicles & Motors 2022

ECOLOGY - VEHICLE AND ROAD SAFETY - EFFICIENCY

BOOK OF ABSTRACTS

October 13th - 14th, 2022
Kragujevac, Serbia

Publisher: Faculty of Engineering, University of Kragujevac
Sestre Janjić 6, 34000 Kragujevac, Serbia

For Publisher: Prof. Slobodan Savić, Ph.D.
Dean of the Faculty of Engineering

Editors: Prof. Jovanka Lukić, Ph.D.
Prof. Jasna Glišović, Ph.D.

Technical preparation: Asisst. prof. Nadica Stojanović, Ph.D.
Assist. prof. Ivan Grujić, Ph.D.
Assist. Slavica Mačužić Saveljić, M.Sc.

Cover: Nemanja Lazarević

CD printing: Faculty of Engineering, University of Kragujevac, Kragujevac

ISBN: 978-86-6335-096-0

Year of publication: 2022.

Number of copies printed: 200

CIP - Каталогизација у публикацији
Народна библиотека Србије, Београд

CIP - Каталогизација у публикацији
Народна библиотека Србије, Београд

629.3(048)(0.034.2)
621.43(048)(0.034.2)

INTERNATIONAL Congress Motor Vehicles and Motors (9 ; 2022 ; Kragujevac)
Ecology - vehicle and road safety - efficiency [Elektronski izvor] : book of abstracts / 9th International Congress Motor Vehicles & Motors 2022, [MVM2022], October 13th-14th , 2022 Kragujevac, Serbia ; [congress organizers University of Kragujevac [and] Faculty of Engineering of the University of Kragujevac, Department for Motor Vehicles and Motors, FE Kragujevac [and] International Journal "Mobility & Vehicle Mechanics"] ; [editors Jovanka Lukić, Jasna Glišović]. - Kragujevac : University, Faculty of Engineering, 2022 (Kragujevac : University, Faculty of Engineering). - 1 elektronski optički disk (CD-ROM) ; 12 cm

Sistemski zahtevi: Nisu navedeni. - Nasl. sa naslovne strane dokumenta. - Tiraž 200. - Bibliografija uz svaki rad.

ISBN 978-86-6335-096-0

а) Моторна возила -- Апстракти б) Мотори са унутрашњим сагоревањем -- Апстракти в) Електрична возила -- Апстракти г) Хибридна електрична возила -- Апстракти
COBISS.SR-ID 76806921

Publishing of this CD Book of proceedings was supported by
Ministry of Education, Science and Technological Development of the Republic of Serbia

SCIENTIFIC BOARD

ORGANIZATIONAL BOARD

President

Prof. Jasna Glišović, Ph.D., UniKg, FE, Serbia

Secretaries

Assist. prof. Nadica Stojanović, Ph.D., UniKg, FE, Serbia
Assist. prof. Ivan Grujić, Ph.D., UniKg, FE, Serbia
Assist. Slavica Mačužić Saveljić, M.Sc., UniKg, FE, Serbia

CONGRESS ORGANIZERS

University of Kragujevac
Faculty of Engineering of the University of Kragujevac
Department for Motor Vehicles and Motors, FE Kragujevac
International Journal "Mobility & Vehicle Mechanics"

CONGRESS PATRONS

Ministry of Education, Science and Technological Development of the Republic of Serbia
City Council of Kragujevac

CONTENT

INTRODUCTORY LECTURES

SECTION A
Power Train Technology

SECTION B
Vehicle Design and Manufacturing

SECTION C
Driver/Vehicle Interface, Information and Assistance Systems

SECTION D
Vehicle Dynamics and Intelligent Control Systems

SECTION E
Transport Challenges in Emerging Economies

9th International Congress
Motor Vehicles & Motors 2022
Kragujevac, Serbia
October 13th-14th, 2022

Motor Vehicles & Motors

MVM2022-016

Luka Ponorac[1]
Ivan Blagojević[2]
Aleksandar Grkić[3]

ANALYSIS OF POWERTRAIN'S WORKLOAD DURING THE TURNING PROCESS OF A HIGH-SPEED TRACKED VEHICLE

KEYWORDS: high-speed tracked vehicles, powertrain workload analyses, tracked vehicle dynamics, tracked vehicle experimental testing, power balance analyses

High-speed tracked vehicles have a great advantage over wheeled vehicles when it comes to overcoming hard condition terrains. In order to maintain high mobility in low adhesion and high moving resistance conditions, these vehicles have robust powertrain components and complex turning mechanisms, which can withstand high torque, while producing a respectful velocity at the same time. This means that the power source, IC engine, has to produce enough power to satisfy all of these requests. Unlike with wheeled vehicles, the selection of the IC engine for a high-speed tracked vehicle is calculated according to the power requirements for the lowest turning radius achieved with the highest vehicle velocity, turning towards the hill of a maximum gradient. To analyze the efficiency of a high-speed tracked vehicle powertrain, it is necessary to understand the powertrain workloads in specific working regimes. Experimental tests are conducted on a specific high-speed tracked vehicle, in various terrain conditions, in order to obtain accurate workload data and isolate the maximum workload regimes. The vehicle is driven on soft soil and in dry conditions, varying turning and rectilinear moving scenarios, with gear and vehicle velocity changes. In order to analyse the power losses during the turning mechanism slip, a scenario where the vehicle is driven with a relatively constant engine input velocity, in specific gear, with field condition change reduced to minimum is selected, varying only the activation pressure of the auxiliary clutch.

The turning process of a high-speed tracked vehicle is evidently the most complex moving scenario, influenced by a large number of variables such as vehicle mass and dimensions, construction of the powertrain and turning mechanism, vehicle velocity, engagement state of the powertrain components, adhesion conditions, moving resistance etc. Given that, special attention is given to analysing the results from power balance point of view. The obtained results indicate that the slip of the turning mechanism friction elements greatly influences the character of the power balance change. For 30% of auxiliary clutch maximum activation pressure value, power delivered to the outer track is 25% lower than when the clutch is fully engaged. When the clutch activation pressure is 60% of the maximum value, the power losses are reduced to 10%. It is obvious that, the lower the activation pressure of the auxiliary clutch, the greater the power loss due to slip, so the logical conclusion is to avoid these working regimes and turn the vehicle with auxiliary clutch fully activated. Unfortunately, these vehicles are most commonly driven in such working regimes, where the vehicle is slightly turned just for trajectory correction. Rarely is the vehicle turned with the lowest values of the turning radius (calculated radius). This means that, for the most of the vehicle usage, the vehicle is turned with great power losses in turning mechanism friction elements.

[1] *Luka Ponorac, AMSS-Center for Motor Vehicles Ltd., Kneginje Zorke 58, luka.ponorac@amss-cmv.co.rs, https://orcid.org/0000-0003-2315-8743*
[2] *Ivan Blagojević, University of Belgrade, Faculty of Mechanical Engineering, Kraljice Marije 16, iblagojevic@mas.bg.ac.rs, https://orcid.org/0000-0002-5776-5990*
[3] *Aleksandar Grkić, AMSS-Center for Motor Vehicles Ltd., Kneginje Zorke 58, aleksandargrkic@amss-cmv.co.rs, https://orcid.org/0000-0002-7890-1787*

The problem of power loss on friction elements can be overcome by modifying the powertrain, in such a way, that the existing turning mechanisms with friction elements are replaced with hydrostatic or electric components, which would provide a continuous trajectory change, with an infinite number of calculated turning radii and no power loss.

ISBN 978-86-6335-096-0