



OTEH 2026

12th INTERNATIONAL SCIENTIFIC CONFERENCE
ON DEFENSIVE TECHNOLOGIES

PROCEEDINGS

TOPICS

AERODYNAMICS AND FLIGHT DYNAMICS

AIRCRAFT

WEAPON SYSTEMS AND COMBAT VEHICLES

AMMUNITION AND ENERGETIC MATERIALS

INTEGRATED SENSOR SYSTEMS AND ROBOTIC SYSTEMS

TELECOMMUNICATION AND INFORMATION SYSTEMS

MATERIALS AND TECHNOLOGIES

QUALITY, STANDARDIZATION, METROLOGY, MAINTENANCE AND EXPLOITATION



12th INTERNATIONAL SCIENTIFIC CONFERENCE
ON DEFENSIVE TECHNOLOGIES

Republic of Serbia, Tara
October 21st - 24th, 2026



Miomir Vukobratović
1931 - 2012

Publisher

The Military Technical Institute
Ratka Resanovića 1, 11030 Belgrade

Publisher's Representative

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Technical Editing

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Printed by

The Military Technical Institute
Ratka Resanovića 1, 11030 Belgrade

CIP - Каталогизација у публикацији
Народна библиотека Србије, Београд

NAUČNO-stručni skup iz oblasti odbramenbih
tehnologija (12 ; 2026 ; Tara)
Proceedings [Elektronski izvor] / 12th
International Scientific Conference on
Defensive Technologies, ОТЕН 2026, Tara,
21-24 October 2026 ; [organized by] Military
Technical Institute, Belgrade ; [editors Aleksandar Kari,
Ljubica Radović]. - Belgrade : Military Technical Insti-
tute, 2026 (Beograd : Military Technical Institute) 1 USB
memorija.

Sistemiški zahtevi: Nisu navedeni. - Nasl. sa
naslovne strane dokumenta. -
Bibliografija uz svaki rad.

ISBN-978-86-81123-95-9

1. Vojnotehnički institut (Beograd)
a) Војна техника - Зборници
b) Технички материјали – Зборници
c) Телекомуникациони системи - Зборници

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PREFACE

Military Technical Institute, the first and the largest military scientific-research institution in the Republic of Serbia with over 77 years long tradition, has been traditionally organizing the OTEH scientific conference, devoted to defense technologies. The Conference is supported by the Ministry of Defense and it takes place every second year.

Its aim is to gather scientists and engineers, researchers and designers, manufactures and university professors in order to exchange ideas and to develop new relationships.

The 12th International Scientific Conference OTEH 2026 is scheduled as follows: lecture on the occasion of “Miomir Vukobratović”, given by Aleksandar Rodić, PhD Eng, and two plenary lectures: given by representatives of DRS RADA Technologies, and presented by Velibor Ilić, PhD Eng “Artificial Intelligence from Perception to Autonomous Action: Applications, Opportunities and Challenges”.

The papers which will be presented at the Conference have been classified into the following topics:

- Aerodynamics and Flight Dynamics
- Aircraft
- Weapon Systems and Combat Vehicles
- Ammunition and Energetic Materials
- Integrated Sensor Systems and Robotic Systems
- Telecommunication and Information Systems
- Materials and Technologies
- Quality, Standardization, Metrology, Maintenance and Exploitation.

The Proceedings contain 160 reviewed papers which have been submitted by the authors from 13 different countries. I would also like to emphasize that we have 15 papers with authors from abroad. The quality of papers accepted for publication achieved very high standard. I expect stimulated discussion on many topics that will be presented online, during two days of the Conference.

On behalf of the organizer I would like to thank all the authors and participants from abroad, as well as from Serbia, for their contribution and efforts which made this Conference possible and successful.

I would also like to thank the Ministry of Science, Technological Development and Innovations of the Republic of Serbia for its financial support.

Finally, dear guests and participants of the Conference, I would like to wish you a pleasant and successful work during the Conference. I am looking forward to see you again at the Conference. All the best and stay healthy.

Serbia, Tara, October, 2026

Col. Aleksandar Kari PhD Eng
President of the Scientific Committee
OTEH 2026

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SECTION I

Aerodynamics and flight dynamics - **AFD**

CONCEPTUAL ANALYSIS OF A RADIAL HYDRAULIC MOTOR DRIVE FOR HEAVY DUTY MILITARY VEHICLES

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Abstract: *The increasing demand for highly mobile specialized vehicles has encouraged the development of alternative drive concepts capable of improving mobility, reliability, and operational flexibility. Radial hydraulic motors represent a promising solution due to their favorable torque characteristics and efficient operation under demanding conditions. This paper investigates the potential application of radial hydraulic motors in heavy wheeled vehicle drive systems. The proposed concept is analyzed from the perspectives of traction performance, power distribution, and operational efficiency. Special consideration is given to vehicle operation in challenging terrain conditions where hydraulic drive systems may provide advantages over conventional mechanical transmissions.*

Keywords: *radial hydraulic motor, hydraulic transmission, heavy vehicles, off-road mobility, vehicle drive systems.*

1. INTRODUCTION

Modern heavy-duty military vehicles require high mobility, reliability, and survivability under severe off-road operating conditions. Overcoming harsh terrains and maintaining combat readiness under high thermal loads necessitate advanced drivetrain configurations. Consequently, developing high-performance propulsion architectures remains a critical research focus in modern military engineering [1].

Conventional mechanical transmissions offer high efficiency but suffer from structural complexity, substantial weight, and rigid torque distribution in multi-axle platforms. These limitations drive the investigation of alternative layouts. In modern vehicle design, individual in-wheel electric drives significantly improve traction control and maneuverability through independent torque distribution. However, while electric hub drives suit light passenger platforms, heavy combat vehicles operating under severe impact and continuous thermal loads require extreme power densities, making hydrostatic radial piston drives a promising alternative for heavy-duty applications [2, 3].

Hydrostatic systems transmit substantial power within compact dimensions, optimizing vehicle packaging and off-road adaptability. Comparative evaluations of electric, hydraulic, and pneumatic rotary actuators indicate that while pneumatic systems offer excellent environmental resilience, their lower torque-to-weight ratios make them unsuitable for high-inertia military platforms [3]. Among hydraulic solutions, multi-stroke radial piston motors remain highly promising due to their High-Torque Low-Speed (HTLS) characteristics, making them ideal for direct wheel drives requiring high traction capability and precise torque control [4 - 9].

The objective of this paper is to investigate radial piston hydraulic motors in heavy multi-axle drivetrains using a multi-domain simulation model developed in *Simcenter Amesim*. The scientific contribution of this work is the development of a mathematical framework for quantifying internal volumetric leakage and thermal loading under continuous gradient climbing conditions, providing design guidelines for future heavy tactical vehicle applications.

2. RADIAL HYDRAULIC MOTOR PRINCIPLE

The Radial Piston Motor presents a crucial actuating component within hydraulic systems and represents a prominent variant of low-speed, high-torque motors (Figure 1.). It finds widespread application in sectors such as national defense, metallurgy, and aerospace. In order to preserve the environment, hydraulic actuators are increasingly expected to exhibit attributes such as low noise, minimal pollution, and smooth operation [8, 9].

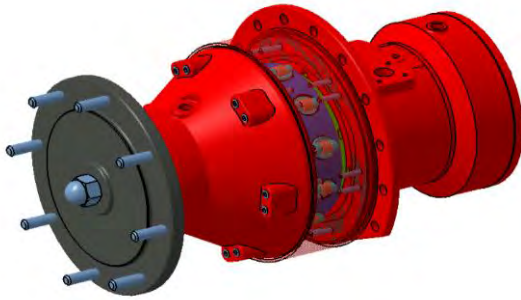


Figure 1. 3D model of Radial piston hydraulic motor

2.1. Construction and operating principle

A multi-stroke radial piston hydraulic motor features a compact and robust configuration designed to withstand high pressure spikes and harsh environmental conditions typical for heavy-duty military vehicles. It consists of the following key components (figure 2.) [10]:

- **Cam-profile Stator:** The stationary outer housing with an internal multi-lobe wavy profile. This component defines the stroke path and number of working cycles per revolution.
- **Rotor (Cylinder Block):** The rotating core containing radially arranged cylinder chambers. It is directly coupled to the wheel hub or output drive shaft via a heavy-duty spline.
- **Piston Assemblies with Rollers:** Reciprocating pistons housed within the rotor chambers. Each piston features a high-strength mechanical roller at its outer end, maintaining continuous contact with the stator profile to transmit the driving force.
- **Flow Distribution Pair:** The heavy-duty fluid commutation mechanism. It contains isolated internal passages that sequentially and accurately direct high-pressure oil to the cylinders and vent low-pressure spent oil back to the reservoir.
- **Output Drive Shaft:** The heavy-duty shaft that extends outside the motor to drive the vehicle's wheel hub or sprocket.
- **Motor Housing (Casing):** The stationary outer housing with an internal multi-lobe wavy profile.

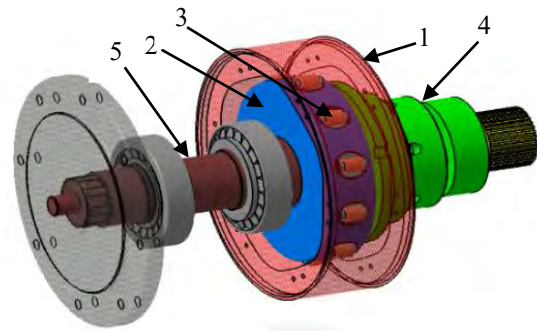


Figure 2. Key parts of radial hydraulic motor

The operational principle relies on converting fluid hydraulic energy into high mechanical output torque through cyclic reciprocating movement [10]:

- **Inlet Phase (Working Stroke):** Pressurized oil passes through the distribution pair (4) and enters the specific cylinder chamber. The high fluid pressure drives the piston (3) radially outward. As the piston roller forces its way down the inclined surface of the stator lobe (1), it yields a high tangential force, forcing the rotor (2) and the vehicle drive shaft (5) into rotation.
- **Dead Centers:** When the piston reaches its maximum outward displacement (Top Dead Center), the distribution slot isolates the chamber from the high-pressure line.
- **Outlet Phase (Return Stroke):** Guided by the continued rotation of the rotor, the descending stator profile mechanically pushes the piston radially inward. Concurrently, the distribution pair links the chamber to the low-pressure drainage network, discharging the oil to the reservoir.

The continuous repetition of these operating cycles generates a smooth rotational motion of the output shaft while maintaining high torque at low rotational speeds.

In the context of dynamic combat environments, understanding these micro-clearances is vital. The intense operating pressures within the piston-cylinder walls and across the sliding interface of the flow distribution pair create internal volumetric leakages. Mitigating these leakages is critical to preserving the volumetric efficiency and continuous traction of heavy-duty military drivetrains [3, 10, 11].

2.2. Main characteristics and comparison with conventional drivetrains

Radial piston hydraulic motors are inherently classified as HTLS displacement machines. Due to their multi-stroke architecture where each piston executes multiple working cycles per single rotor revolution, these units develop exceptionally high displacement volumes within a remarkably compact envelope [3]. This design delivers ripple-free, stable torque even at near-zero speeds, which represents a critical advantage for heavy military platforms navigating cross-country obstacles. Furthermore, their outstanding starting torque efficiency

ensures that fully loaded armored vehicles can initiate motion or resume climbing on steep, unstable inclines without any dangerous rollback [4, 6].

When integrated into heavy-duty tactical propulsion systems, radial piston configurations offer distinct structural and operational advantages over conventional mechanical and axial hydraulic alternatives. Standard mechanical drivetrains rely on complex networks of rigid drive shafts, multi-speed transfer cases, and heavy differentials. Implementing a radial hydrostatic drive eliminates these components entirely by utilizing an in-wheel hub-motor configuration. This architectural shift significantly reduces the structural weight of the platform, lowers its overall silhouette, and dramatically increases ground clearance to enhance off-road mobility [4, 6].

When compared to axial piston motors, which are fundamentally high-speed, low-torque devices, the radial alternative proves far more suitable for direct wheel drives. Driving a heavy armored vehicle wheel with an axial motor necessitates the integration of bulky planetary reduction gearboxes to multiply torque. Conversely, radial piston motors drive the wheel hub directly without mechanical gear reduction. This reduction in the total number of moving parts lowers mechanical friction losses, simplifies maintenance, and minimizes the vehicle's vulnerability to ballistic damage in combat environments [4, 6].

3. APPLICATION OF RADIAL HYDRAULIC MOTORS IN HEAVY MILITARY VEHICLES

To meet the extreme mobility demands of a heavy 6x6 tactical vehicle, a closed-loop hydrostatic drivetrain architecture is proposed. This system completely replaces the traditional mechanical gearbox, drive shafts, and differentials. The operational concept and fluid routing are illustrated in the system block diagram (Figure 3) [7, 12].

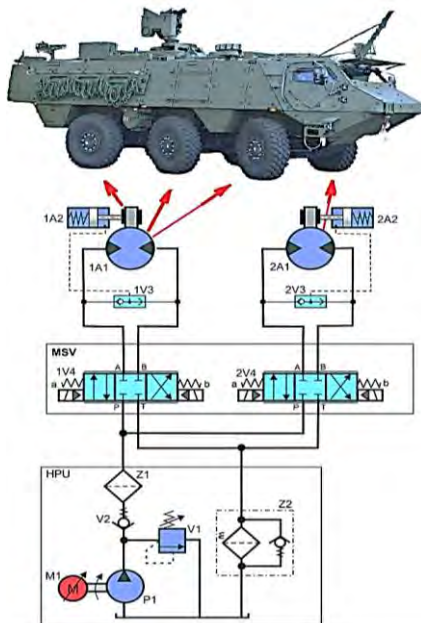


Figure 3. – Schematic diagram of conventional hydraulic propulsion system of the military vehicle

The schematic configuration of the proposed multi-wheeled 6x6 hydrostatic drive system consists of three main sub-assemblies: the Hydraulic Power Unit (HPU), the Main Valve Block (MSV), and the dynamic propulsion-braking hub stations. The fluid power is generated by the engine-driven pump P1, which is protected against overpressure transients by the safety relief valve V1. High-pressure filtration is handled via filter Z1, while return-line fluid conditioning and thermal management are achieved through the bypass-equipped radiator block Z2. Fluid flow rate and direction are independently regulated by two proportional directional valves, 1V4 and 2V4, embedded in the MSV block. Valve 1V4 directly controls the fluid delivery to the left-side radial piston hydraulic motor 1A1, which simultaneously drives all three left-side wheels through parallel porting lines. Conversely, valve 2V4 governs the right-side radial piston motor 2A1, enabling asymmetric flow adjustments for precise skid-steering maneuvers under tactical off-road scenarios [7].

3.1. Mathematical model

To evaluate the conceptual performance of a high-torque radial piston hydraulic motor for heavy-duty military operations, a comprehensive mathematical model is established. This model defines the relationship between hydraulic input energy, internal mechanical and volumetric losses, and the dynamic output performance required to propel a heavy military vehicle under severe off-road conditions.

The rotational speed of the radial hydraulic motor is directly governed by the volumetric flow rate of the hydraulic fluid supplied to its cylinders.

The theoretical flow rate Q_{th} [m³ s⁻¹], which assumes zero leakage and ideal geometry, is defined as [10, 13]:

$$Q_{th} = V_d \cdot n \quad (1)$$

Where:

- V_d is the displacement of the radial motor [m³ rev⁻¹];
- n is the rotational speed of the motor shaft [rps].

In heavy-duty military applications, high operating pressures lead to internal fluid bypass across the piston-cylinder clearances and the distribution valve. Therefore, the actual flow rate Q_{act} required by the motor is expressed as [13]:

$$Q_{act} = Q_{th} + Q_{leak} \quad (2)$$

Where Q_{leak} represents the internal volumetric leakage flow rate [m³ s⁻¹].

Radial piston motors are categorized as Low-Speed High-Torque (LSHT) drives, making them ideal for overcoming steep slopes and rough terrain.

The ideal or theoretical torque T_{th} (Nm) generated by the motor depends strictly on its geometric displacement and the differential pressure [10, 13]:

$$T_{th} = \frac{V_d \Delta p}{2\pi} \quad (3)$$

Where:

$$\Delta p = p_{in} - p_{out} \quad (4)$$

is the pressure drop across the motor (Pa).

The actual torque T_{act} delivered to the vehicle's wheel or sprocket is lower than the theoretical value due to mechanical friction between moving components (pistons, rollers, and cam lobes). It is calculated as [13]:

$$T_{act} = T_{th} - T_{loss} = T_{th} \eta_{hm} \quad (5)$$

Where:

- T_{loss} is the total friction torque loss (Nm);
- η_{hm} is the hydro-mechanical efficiency of the motor.

The conversion of hydraulic power into mechanical power determines the overall tractive capability of the vehicle.

The hydraulic input power P_{hyd} (W) delivered by the system pump is given by [13]:

$$P_{hyd} = Q_{act} \Delta p \quad (6)$$

The effective mechanical power P_{mech} (W) available at the output shaft to drive the vehicle is defined as [13]:

$$P_{mech} = T_{act} \omega = T_{act} \frac{2\pi n_{rpm}}{60} \quad (7)$$

Where:

- ω is the angular velocity of the shaft (rad/s);
- n_{rpm} is the shaft speed in revolutions per minute (rpm).

Military vehicles operate under extreme temperature fluctuations (from -30°C to $+50^\circ\text{C}$), which drastically alters oil viscosity and loss characteristics.

The internal leakage flow Q_{leak} can be mathematically modeled using the Wilson-based hydraulic loss approach [13]:

$$Q_{leak} = \frac{C_s V_d \Delta p}{\mu} \quad (8)$$

Where:

- C_s is the dimensionless laminar leakage coefficient of the radial motor;
- μ is the dynamic viscosity of the hydraulic fluid (Pa·s).

The volumetric efficiency η_v is then formulated as [13]:

$$\eta_v = \frac{Q_{th}}{Q_{act}} = 1 - \frac{Q_{leak}}{Q_{act}} \quad (9)$$

The torque loss T_{loss} comprises both Coulomb (constant) friction and viscous fluid shear friction within the motor housing [13]:

$$T_{loss} = (C_f V_d \Delta p) + (C_v V_d \mu \omega) \quad (10)$$

Where:

- C_f is the mechanical friction coefficient;
- C_v is the viscous drag coefficient.

Consequently, the total efficiency of the hydraulic drive η_t is expressed as [13]:

$$\eta_t = \eta_v \eta_{hm} = \frac{P_{mech}}{P_{hyd}} \quad (11)$$

4. SIMULATION MODEL AND DISCUSSION

To evaluate the hydrostatic powertrain concept for the 6x6 heavy-duty tactical vehicle, a comprehensive multi-domain simulation model was established within the *Simcenter Amesim* environment. The interconnected structural architecture of this simulation framework is schematically detailed in Figure 4.

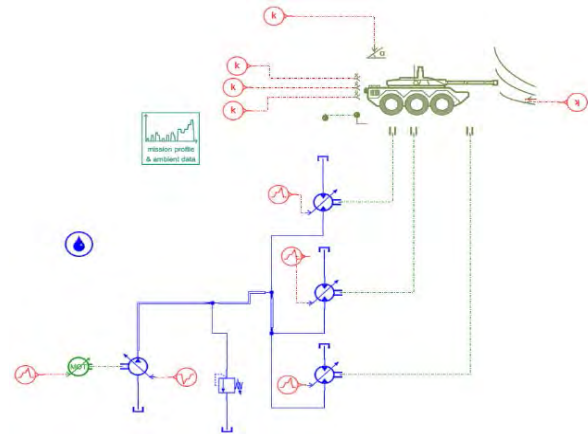


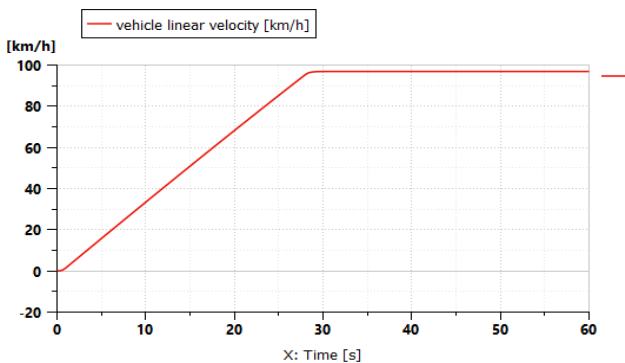
Figure 4. 6x6 concept combat vehicle drive diagram

The model couples the high-pressure fluid power network directly with the longitudinal vehicle dynamics of the 3-axle platform. The hydraulic propulsion layer consists of the primary pump unit supplying pressurized fluid to three parallel-connected in-wheel radial piston hydraulic motors, which model one complete side of the tactical vehicle. The advanced nature of this multi-domain model lies in its capacity to incorporate dynamic external environment boundaries (denoted by coefficient blocks k), which actively process terrain inclinations, aerodynamic drag, and variable tire-soil rolling resistance. The baseline parameters used in this simulation framework are summarized in Table 1 [12, 14, 15]

Table 1. Operational parameters of the 6x6 hydrostatic powertrain model

Quantity	Value
Total vehicle mass	25000 kg
Tire Specification	14R20
Prime Mover Speed	2000 rpm
Pump Displacement	600 [cm ³ rev ⁻¹]
In-Wheel Motors Displacement	975 [cm ³ rev ⁻¹]
Rolling resistance	0.02
Fluid density	850 [kg m ⁻³]
Dynamic viscosity	51 [cP]
Road slope	0 %
Wind velocity	10 [m s ⁻¹]

The dynamic velocity response of the 25-tonne combat vehicle operating under a 10 [m s⁻¹] headwind profile is illustrated in Figure 5.

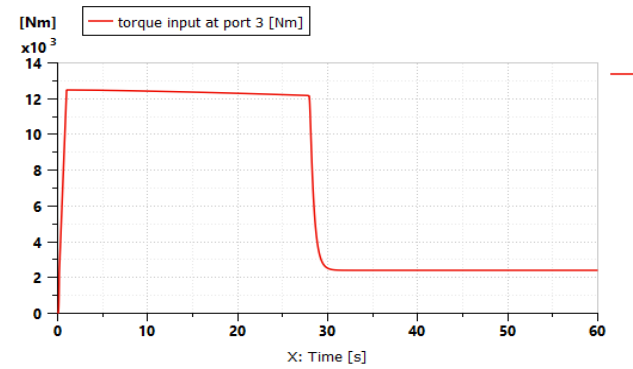
**Figure 5.** Diagram of vehicle velocity in 60s operational cycle

The simulated transient kinematic profile comprises three operational phases:

- **System Activation (0–1 s):** A 1-second response lag occurs due to the engine ramp-up to 2000 (rpm) and the pilot pressure buildup required to disengage the Spring-Applied Hydraulic-Released (SAHR) hub brakes.
- **Linear Acceleration (1–22 s):** Following brake release, the large 975 [cm³ rev⁻¹] displacement of the in-wheel motors generates high torque, overcoming the static inertia of the 25000 (kg) chassis.
- **Steady-State Dash (22–60 s):** The vehicle reaches a maximum velocity of 97 km/h, establishing full hydrostatic equilibrium where wheel torque matches aerodynamic drag and rolling resistance.

The dynamic torque requirement at the wheel hub (Port 3)

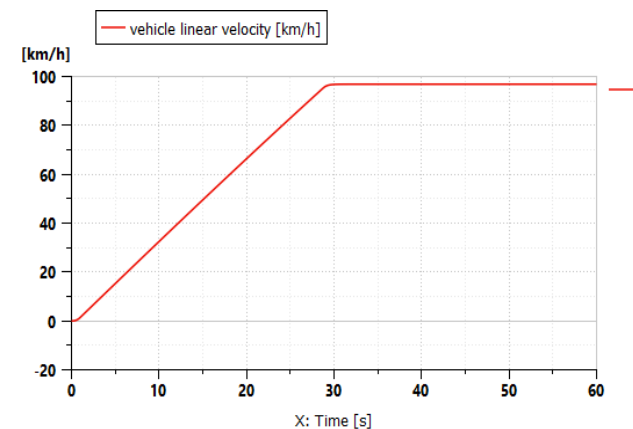
throughout the 60-second operational cycle is quantified in Figure 6.

**Figure 6.** Simulated torque input profile at the axle

The torque curve validates the powertrain's capacity to sustain heavy-duty tactical movement:

- **Inertial Launch (0–1 s):** Drive torque peaks instantly at 12500 (Nm) to overcome the static inertia of the 25000 (kg) chassis and terrain resistance.
- **Sustained Acceleration (1–28 s):** Torque remains at an elevated plateau, shifting from 12500 (Nm) to 12200 (Nm), confirming maximum system pressure drop across the in-wheel motors.
- **Steady-State Relaxation (28–60 s):** At a cruise velocity of 97 km/h, torque drops rapidly between 28–30 s, settling at a 2400 (Nm) baseline to counteract rolling resistance and the 10 [m s⁻¹] wind drag.

To assess operational limitations under severe conditions, a separate simulation evaluates vehicle traction on a steep 15° road gradient (26.8% slope). To ensure a rigorous comparison, all hardware and fluid parameters remain identical to Table 1. This analysis focuses on how continuous gravitational loading alters drivetrain kinematics, pressure profiles, and volumetric leakage. Results are presented in Figures 7 and 8.

**Figure 7.** Diagram of vehicle velocity under the slope of 15°

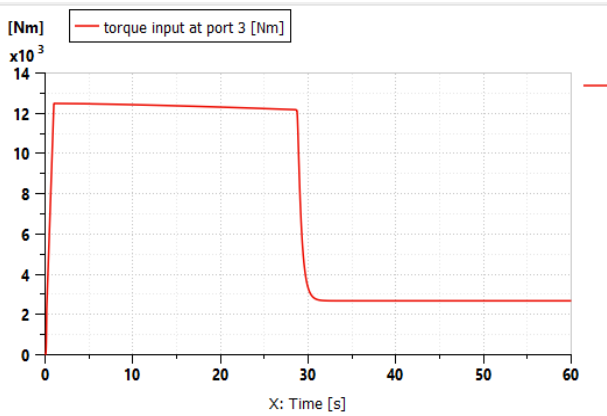


Figure 8. Diagram of simulated axle torque under the slope of 15 °

Although the drivetrain achieves 97 km/h on the 15° slope, grade resistance extends the acceleration phase and shifts hydrostatic equilibrium from 22 s to 30 s. This prolonged peak-pressure window forces fluid through the micro-clearances of the flow distribution pair and piston-

cylinder walls, driving the volumetric leakage Q_{leak} to a higher plateau than on flat terrain. While the fluid dynamic viscosity of 51 [cP] at 40 °C prevents a total efficiency collapse, continuous high-load shearing generates severe thermal loads. This demonstrates that for multi-axle armored platforms executing tactical maneuvers on steep inclines, the flow distribution pair clearances must be precisely optimized to mitigate pressure-induced volumetric losses and prevent thermal thinning.

From a fluid power perspective, the operational discrepancy between flat terrain and the 15° slope highlights the volumetric allocation dynamics within the hydrostatic loop. On flat terrain, the main hydraulic pump's delivery flow rate rapidly satisfies the cumulative volumetric demand of the three parallel-connected wheel motors, reaching full flow equilibrium at 22 s. Conversely, during the steep climb, sustained gravitational resistance forces the wheel motors to operate under peak pressure drops to maintain the necessary torque output. This critical shift alters the flow rate distribution: while the main pump operates at a regulated displacement providing a baseline input flow, the high-pressure differential across the wheel motors drives fluid through internal clearances. Consequently, the individual flow rate utilized for effective mechanical work decreases

due to the elevated volumetric leakage Q_{leak} . This behavior indicates that the efficiency bottleneck under severe thermal and mechanical loads is not the raw volumetric capacity of the main pump, but rather the localized leakage control within the flow distribution pairs of the in-wheel radial piston units.

5. CONCLUSION

This paper presented a conceptual analysis of an in-wheel hydrostatic drivetrain driven by multi-stroke radial piston motors for a 25-tonne 6×6 combat vehicle. The multi-domain simulation demonstrated that the proposed drive

can provide sufficient tractive effort, achieving a maximum velocity of 97 km/h. Comparative analysis revealed that a steep 15-degree road inclination proportionally increases the system response time and shifts the stabilization threshold from the 22nd to the 30th second. This prolonged operation under maximum pressure conditions increases the significance of internal volumetric leakage within the flow distribution pairs. Although the dynamic fluid viscosity of 51 cP at 40 °C prevents a complete efficiency degradation, the sustained high-pressure gradient during severe slope operation generates considerable thermal loads. These findings highlight that precise CFD analysis and experimental optimization of flow distribution pair clearances are essential for improving the efficiency and reliability of advanced tactical wheeled platforms. Future work will focus on structural optimization of these critical micro-clearances and subsequent experimental validation using a dedicated hydraulic test rig.

References

- [1] NUNEZ,P., JONES,R., SHOOP,S.: High-Fidelity Ground Platform and Terrain Mechanics Modeling for Military Applications, Technical Report, Defense Technical Information Center, Accession Number: ADA432776, (2004)
- [2] POPOVICI, V., GRIGORAS, I. R., RAKOSI, E., ULIAN, T. M., MANOLACHE, G., POPA, A. G., PETROVAN, S.: A New Approach to In-Wheel Motor Solutions for Electric Vehicles, *World Electric Vehicle Journal*, 17(2) (2026) 87
- [3] TANAKA,K., OKAZAKI,T., URABE,T.: Comparative Study on Dynamic Characteristics of Hydraulic, Pneumatic and Electric Motors, *Proceedings of the ASME/BATH 2013 Symposium on Fluid Power and Motion Control*, (2013) 10.1115/FPMC2013-4459
- [4] ABAITANCEI,H., RADU,S., MUNTEAN.B., IRMIA,C.: Multi-Domain and Durability Analysis of a Hybrid Hydraulic Vehicle, (2016) 823:217-222
- [5] LI,C., JIANG,T., LIU,C., XU,H., SHI,G.: Investigation of the leakage in the flow distribution pair of radial piston hydraulic motors through CFD analysis and experiments, *Flow Measurement and Instrumentation*, 96 (2024) 102555.
- [6] MANNESMANN REXROTH: *Hydrostatic Transmissions for Wheeled and Tracked Vehicles*, Technical Handbook, Rexroth Hydraulics, (1998).
- [7] DINDORF,R.: Functional Safety of the Hydraulic Drive Control System of a Tracked Undercarriage, *The Archives of Automotive Engineering - Archiwum Motoryzacji*, 103(1) (2024) pp. 21-37
- [8] BAŠTA,T.M.: *Mechanical hydraulics*, Faculty of mechanics, Belgrade, 1986.
- [9] SAVIĆ,V.: *Oil hydraulics, hydraulic components and systems*, Zenica, 1986.
- [10] GIAVARINI,F.: *Analysis and Simulation of a Radial Piston Hydraulic Motor*, Master's degree thesis, Politecnico di Torino, (2022).

- [11]MERITT H.E.: Hydraulic Control Systems, John Wiley & Sons, (1967).
- [12]PATRIA LAND SYSTEMS: Patria 6x6 - Modern Protection and Extreme Mobility, Technical Specification Brochure, Oy Patria AB, Finland, (2023)
- [13]RADOSAVLJEVIĆ,M., PETROVIĆ,R., ŽEŽELJ,B., BELOVIĆ,D., CVEJIĆ,S.: Mathematical Modeling and Experimental Tests of Working Parameters of Piston-Radial Pumps in Hydraulic Systems of Mobile Machines, Applied Sciences, 14(21) (2024) p. 9979.
- [14]WONG, J. Y.: Theory of Ground Vehicles, 4th Edition, John Wiley & Sons, New York, (2008)
- [15]SHELL INTERNATIONAL PETROLEUM: Shell Tellus S2 MX 46 - Industrial Hydraulic Fluid Technical Data Sheet, Shell Lubricants, Version 2.4, (2021)