

PRIKAZ POGRAMA MATLAB & SIMULINK VERZIJA R2022a

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Kratak sadržaj: Naziv programa Matlab je skraćenica od MATrix LABoratory, idejni tvorac programa Matlab je Jack Little iz firme: The MathWorks. U radu prikazujemo Program Matlab & Simulink R2022a. Matlab sadrži Toolbox-ove, velike biblioteke funkcija i kolekcija alata za usko specijalne proračune tj. područja istraživanja. Primena programa Matlab obuhvata istraživanja u oblastima robotike, inteligentnih sistema, bespilotnih letilica - dronova, autonomnih samovozećih automobila, elektrotehnike, mašinstva, fizike. Prvenstveno je namenjen rešavanju tehničkih problema predstavljenih u obliku vektora i matrica. Rezultati se mogu atraktivno prezentovati, počev od matrica, 2D i 3D grafikonima, do modeliranja i simulacije kompleksnih sistema. U radu prikazujemo mogućnosti Matlaba u atraktivnoj istraživačkoj oblasti samovozećih automobila.

Ključne reči: MATrix LABoratory, Matlab & Simulink R2022A, Toolbox, primena programa Matlab, modeliranje i simulacija kompleksnih sistema, samovozeći automobil.

REVIEW TO THE MATLAB & SIMULINK PROGRAM VERSION R2022a

Abstract: The name of the Matlab program is an abbreviation of MATrix LABoratory, the idea creator of the Matlab program is Jack Little from the company: The MathWorks. The paper presents the Matlab & Simulink R2022A Program. Matlab contains Toolboxes, large function libraries and a collection of tools for narrowly special calculations. areas of research. The application of the Matlab program includes research in the fields of physics, electrical engineering, mechanical engineering, robotics, intelligent systems, unmanned aerial vehicles - drones, autonomous self-driving cars. It is primarily intended for solving technical problems presented in the form of vectors and matrices. The results can be attractively presented, starting from matrices, 2D and 3D graphs, to modeling and simulation of complex processes. The paper presents the possibilities of Matlab in the attractive research area of self - driving cars.

Key Words: MATrix LABoratory, Matlab & Simulink R2022A, Toolbox, Matlab application, modeling and simulation of complex systems, Self-Driving Cars.

1. UVOD

Naziv programa Matlab je skraćenica od MATrix LABoratory, idejni tvorac programa Matlab je firma: The MathWorks [1-2]. U radu prikazujemo Program Matlab & Simulink R2022a.

Početkom 1970-ih godina, Cleve Moler šef Instituta za Računarstvo univerziteta University of New Mexico je počeo razvijati Matlab. Cilj mu je bio olakšati rad studentima koji nisu poznavali programski jezik Fortran da bi koristili programske pakete Linpack i Eispack. Uskoro, za razvoj Matlaba, zainteresovali su se matematičari koji su se bavili primenjenom matematikom. Inženjer Jack Little 1983 god. posetio je Moler-a, shvatio je značaj istraživanja i zajedno sa Steve Bangertom, u programskom jeziku C kreirali su novu verziju Matlab-a i 1984 god. osnovali su firmu The MathWorks. Little se bavio zadacima upravljanja tehničkih sistema, tako da su program Matlab prvo primenili u zadacima upravljanja. Danas firma MathWorks se nalazi u 16 zemalja, ima više od 5000 zaposlenih, sa centralom u Natick-u, Massachusetts, USA.

Program Matlab 1.0 se pojavio 1984 god. prvo korišćen interno, za naučna istraživanja, tek je od verzije 4.0, 1992 god. postao u svetu javno dostupan. Gyula Mester je počeo koristiti Matlab za simulacije dinamičkih sistema od 1986 god., za vreme dok je boravio na višemesečnom studijskom boravku na RWTH Aachen University u Nemačkoj. Za rad u Matlabu treba koristiti Windows ili Linux platforme. 2000 god. su ponovo kreirali Matlab, tako da je postao programski paket široke namene i u oblastima: obrazovanja, numeričke analize, obrada slika itd.

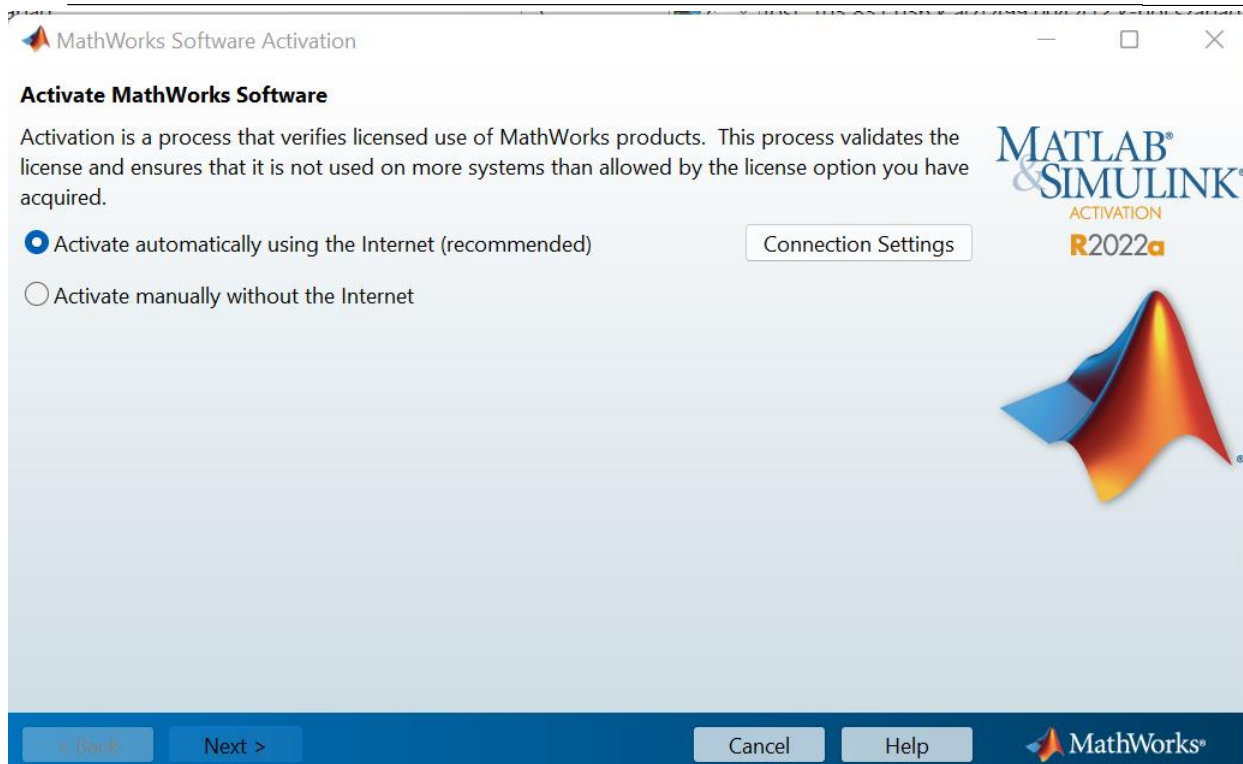
Struktura rada obuhvata sledeća poglavlja: 1. Uvod. 2. Program Simulink. 3. Program Matlab sa osnovama autonomne vožnje. 4. Zaključak i Literatura.

2. PROGRAM SIMULINK

Simulink je razvijan nezavisno od Matlab-a, ali čini njegov sastavni deo. Simulink simulira nelinearne dinamičke sisteme u vizuelnom okruženju, veći deo rada svodi se na crtanje blok-dijagrama i njihovo funkcionalno povezivanje. Verzija programa R2022a obuhvatiće ukupno 15 novih programa Simulinka:

Simulink Real-Time, Simulink Desktop Real-Time, Simulink Check, Simulink 3D Animation, Simulink Test, Simulink Report Generator, Simulink Design Optimization, Simulink Compiler, Simulink Control Design, SimBiology, Simulink Coder, Simulink PLC Coder, Simulink Design Verifier, Simulink Coverage, Simulink Code Inspector [3-15].

Prema tome u 2022 godini očekuje se nova verzija programa Matlab Simulink R2022a, slika 1.



Slika 1. Matlab Simulink R2022a.

3. PROGRAM MATLAB - AUTOMATED DRIVING TOOLBOX – AUTOMATSKE VOŽNJE

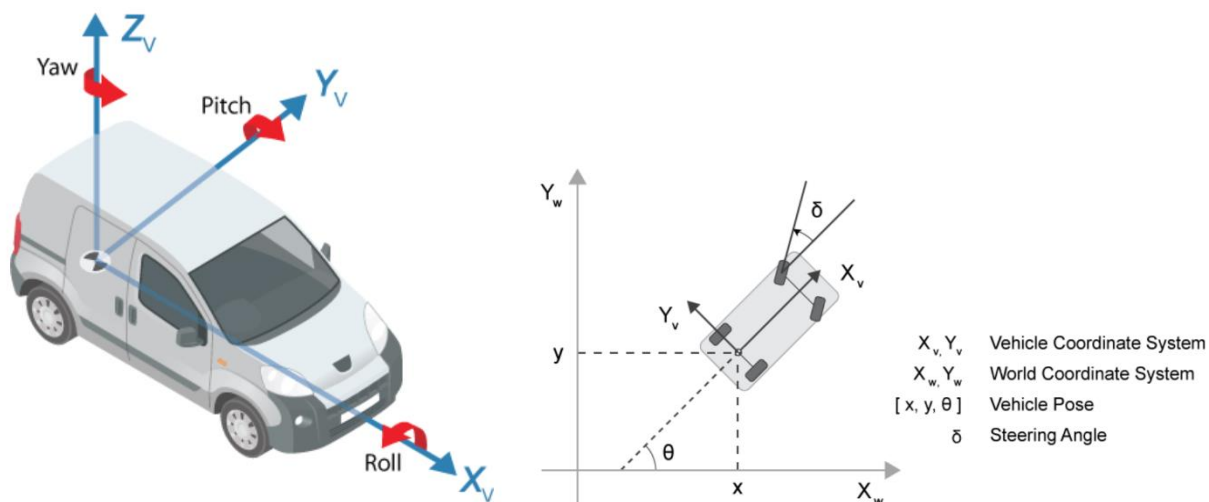
Matlab sadrži Toolbox-ove, velike biblioteke funkcija i kolekcija alata za usko specijalne proračune tj. područja istraživanja. Prvenstveno je namenjen rešavanju tehničkih problema predstavljenih u obliku vektora i matrica. Rezultati se mogu atraktivno prezentovati, počev od matrica, 2D i 3D grafikonima, do modeliranja i simulacije kompleksnih procesa. Primena programa Matlab obuhvata istraživanja u oblastima fizike, elektrotehnike, mašinstva, robotike, inteligentnih sistema, bespilotnih letilica - dronova, autonomnih samovozećih automobila. Prikazujemo uvod u Toolbox-ove autonomne vožnje samovozećih automobila. Verzija Matlab Simulink R2022a obuhvata Automated Driving Toolbox za samovozeće automobile. Realizaciju vožnje samovozećeg automobila pored Automated Driving Toolbox-a možemo koristiti i sledeće Toolbox-ove programa (ukupno 71):

WLAN Toolbox, Wavelet Toolbox, Vision HDL Toolbox, Computer Vision Toolbox, Vehicle Network Toolbox, Vehicle Dynamics Blockset, Sensor Fusion and Tracking Toolbox, Text Analytics Toolbox, SerDes Toolbox, Statistics and Machine Learning Toolbox, Simscape, Signal Integrity Toolbox, Symbolic Math Toolbox, Satellite Communications Toolbox, Signal Processing Toolbox, Stateflow, SimEvents, Requirements Toolbox, RF PCB Toolbox, Reinforcement Learning Toolbox, RF Toolbox, Robust Control Toolbox, RF Blockset, Radar Toolbox, Powertrain Blockset, Simscape Electrical, Fixed Point Designer, Predictive Maintenance Toolbox, Optimization Toolbox, Navigation Toolbox, Deep Learning Toolbox, Motor Control Blockset, Model Predictive Control Toolbox, Mapping Toolbox, Model-Based Calibration Toolbox, LTE Toolbox, Lidar Toolbox, Wireless HDL Toolbox, Simscape Driveline, Image Processing Toolbox, System Identification Toolbox, Instrument Control Toolbox, Image Acquisition Toolbox, SoC Blockset, DSP HDL Toolbox, HDL Coder, Global Optimization Toolbox, GPU Coder, Fuzzy Logic Toolbox, Filter Design HDL Coder, HDL Verifier, Embedded Coder, DSP System Toolbox, Parallel Computing Toolbox, Deep Learning HDL Toolbox, Datafeed Toolbox, DDS Blockset, Database Toolbox, Data Acquisition Toolbox, Control System Toolbox, Matlab Compiler, Communications Toolbox, Curve Fitting Toolbox, Audio Toolbox, AUTOSAR Blockset, Phased Array System Toolbox, Mixed-Signal Blockset, Antenna Toolbox, 5G Toolbox [16-25].

Toolboxovi automatske vožnje sadrže algoritme za kreiranje, simulacije i testiranje sistema automatske vožnje. Omogućuje planiranje i testiranje sistema veštačkog vida, lidar sisteme, fuziju senzora, planiranje putanje i upravljanje samovozaćeg automobila – automatske vožnje. Realizuje video, lidar i praćenje mapa kretanja.

Automated Driving Toolbox™ koristi ove koordinatne sisteme:

- Globalni: fiksni univerzalni koordinatni sistem u koji su smeštena sva vozila i njihovi senzori.
- Lokalni, vozilo: usidreno u vozilo, obično se koordinatni sistem vozila postavlja na tlo tačno ispod sredine zadnje osovine.
- Senzor: specifičan za određeni senzor, kao što je kamera ili radar.
- Prostorni: specifično za sliku snimljenu kamerom. Lokacije u prostornim koordinatama izražene su u jedinicama piksela.
- Šablon: koordinatni sistem šablona, obično se koristi za kalibraciju senzora kamere.



Slika 2. Globalni (World: X_w, Y_w) i lokalni (Vehicle: x_v, y_v) koordinatni sistemi.

Simulacija automatske vožnje samovozećih automobila nam omogućuje da verifikujemo nove naučne doprinose, što je, sem razvoja ove danas veoma atraktivne naučne discipline veoma važno i pri izradi i verifikaciji rezultata doktorskih disertacija iz autonomne vožnje. Simulacija automatske vožnje je od bitne važnosti za ispitivanje funkcionalnosti Automated Driving Toolbox-a i za razvoj savremenih algoritama upravljanja samovozećih automobila. Toolbox automatske vožnje – Automated Driving Toolbox- sa ostalim Toolbox-ovima u toku simulacije automatske vožnje omogućuje označavanje osnovnih podataka, vizualizaciju senzorskih podataka, detekciju trake i vozila, obradu oblaka lidarskih tačaka, praćenje i spajanje senzora, generisanje scenarija vožnje i modeliranje senzora [26-34].

3. ZAKLJUČAK

U radu prikazujemo Program Matlab & Simulink R2022a koji obuhvata Automated Driving Toolbox za samo-vozeće automobile. Automated Driving Toolbox sadrži algoritme za kreiranje, simulacije i testiranje sistema automatske vožnje. Omogućuje planiranje i testiranje sistema veštačkog vida, lidar sisteme, fuziju senzora, planiranje putanje i upravljanje samovozaćeg automobila – automatske vožnje. Realizuje video, lidar i praćenje mapa kretanja. Naveli smo Toolbox-ove programa, za simulaciju automatske vožnje, ukupno ih ima 71 i možemo konstatovati da je programski paket Matlab postao izvrstan program paket za simulaciju upravljanja samovozećih automobila, generisanje scenarija vožnje, modeliranje senzora i verifikaciju teorijskih rezultata istraživanja.

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