

Laboratorij za načrtovanje integriranih vezij

Univerza v *Ljubljani* Fakulteta *za elektrotehniko*

Andrej Trost Uvod v laboratorijske vaje 2020/21

Integrirana vezja Načrtovanje digitalnih elektronskih sistemov

https://lniv.fe.uni-lj.si/b.html
https://lniv.fe.uni-lj.si/altera/

Digitalna integrirana vezja - tehnologija

- razvoj popolnoma naročniških digitalnih integriranih vezij je zelo zahteven
- nekatere tehnološke izvedbe omogočajo avtomatizacijo: uporaba standardnih celic ali polja vrat
 - Electronic Design Automation tools

naročniška



polje vrat



standardne celice



logični gradniki 74nn



namensko vezje

ASIC

Po funkciji jih delimo na:

- enostavne logične gradnike
- vezja za specifičen namen (Application Specific IC)
- univerzalna vezja, npr. mikroprocesorji

Programirljiva vezja FPGA

- programirljiva vezja omogočajo razvoj namenskega vezja z vnaprej izdelanim čipom
- hiter razvoj, univerzalnost, hitra obdelava signalov in odziv paralelno delovanje
- standarden opis vezja (VHDL, Verilog)



Field Programmable Gate Array

Izdelava digitalnega vezja v FPGA

- določimo vsebino in povezave v logičnih celicah
- vzpostavimo povezave v matriki in z zunanjimi priključki
- postopek tehnološke preslikave je avtomatiziran!



Koraki dela z orodji za vezja FPGA



Razvoj digitalnega vezja / sistema

- sistemi iz vnaprej pripravljenih komponent (knjižnica, IP) in specifičnih vezij
- vezja z natančnimi časovnimi parametri in omejitvami sintetiziramo iz opisa VHDL ali Verilog



Študent bo znal:

Opisati logično vezje

- strukturno (shema)
- funkcijsko
- RTL in
- postopkovno
- razviti preprost CPU, ki izvaja algoritem v strojni kodi
- uporabljati orodja za FPGA
- izdelati sistem z vmesniki in namensko logiko v VHDL

Tema: funkcijski generator

- modeli osnovnih vezij
- sekvenčni stroj
- Projekt IV:
- 12-bitni mikroprocesor
- periferne enote
- digitalni sintetizatorProjekt NDES:
- funkcijski generator



Namestitev programske opreme

https://www.altera.com/products/design-software/fpga-design/quartus-prime/download.html



Download Intel® Quartus® Prime Software

Three Intel® Quartus® Prime Editions to Meet Your System Design Requirements

Pro Edition

The Intel® Quartus® Prime Pro Edition Software supports the advanced features in Intel's nextgeneration FPGAs and SoCs with the Intel® Agilex[™], Intel® Stratix® 10, Intel® Arria® 10, and Intel® Cyclone® 10 GX device families.

Download now (paid license required) \rightarrow

Standard Edition

The Intel® Quartus® Prime Standard Edition software includes extensive support for earlier device families in addition to the Intel® Cyclone® 10 LP device family.

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Lite Edition

The Intel[®] Quartus[®] Prime Lite Edition software supports Intel's low-cost FPGA device families.

Download now (free, no license required) →

potrebna je brezplačna registracija na spletni strani



nastavitve za prenos programske opreme

Operating System 😗 🛛 🎊 Windows 🔿 🐧 Linux

✓ The Quartus Prime Lite Edition Design Software, Version 20.1 includes functional and security updates. Users should keep their software up-to-date and follow the <u>technical recommendations</u> to help improve security. Additional security updates are planned and will be provided as they become available. Users should promptly install the latest version upon release.

✓ The Quartus Prime Lite Edition Design Software, Version 20.1 is subject to removal from the web when support for all devices in this release are available in a newer version, or all devices supported by this version are obsolete. If you would like to receive customer notifications by e-mail, please subscribe to our <u>subscribe to our customer notification mailing list</u>.

✓ The Quartus Prime Lite Edition Design Software, Version 20.1 supports the following device families: Arria II, Cyclone 10 LP, Cyclone IV, Cyclone V, MAX II, MAX V, and MAX 10 FPGA. <u>More</u>



Note: The Quartus Prime software is a full-featured EDA product. Depending on your download speed, download times may be lengthy.

Namestitev Quartus Prime Lite

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Opis vezja z enakim imenom, kot projekt



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Simulacija z orodjem ModelSim

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Nastavitev Quartusa za uporabo ModelSim

🕥 Options

Category:

General

EDA Tool Options

EDA Tool Options

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ModelSim - INTEL FPGA STARTER EDITION 2020.1



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Določitev prikazanih signalov

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Navodila na:

https://lniv.fe.uni-lj.si/altera/modelsim.htm