

# DEVELOPMENT OF THE THEORY OF MATHEMATICAL MODELING AND ITS APPLICATION IN EDUCATION AND INDUSTRY

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## LASER ENGRAVING MACHINES MODELING. CONTROL PROBLEMS

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A wide range of laser engraving machines is available on the computer hardware market. Qualified installation and further control of such equipment is vital to operate it appropriately.

The goal of this study is to develop a control system for a laser engraving machine.

**Material and methods.** In this research we studied a laser engraving machine model. We applied digital modeling methods and software development technics; we used DRV8825, A4988 drivers.

**Findings and their discussion.** We designed a laser engraving machine model in Solidworks program. The physical device is built in accordance with this model.

The Arduino UNO (Image 1) microcontroller board based on the microchip ATmega328P forms the core of the engraving machine control system. Simplicity and versatility are the main advantages of the Arduino UNO as well as a USB interface to connect the board to a computer. The board can be supplied with power either by an AC/DC adapter, a USB cable or by an external battery.



Image 1. Arduino UNO

The NEMA 17, 1.7A stepper motors were used to move to position the axes carriages. The motors are controlled by the drivers DRV8825 or A4988 (Image 2). These drivers differ in their step microstepping parameters and maximum allowed current.



Image 2. Drivers DRV8825 and A4988

The motor controlling driver connects to the control system through the CNC Shield v.3.0 extension chipboard designed to be used in engraving or milling machines with digital program control system based on the Arduino UNO microcontroller.

CNC Shield v.3.0 (Image 3) extension chipboard communicates with Arduino UNO and the motor drivers via Arduino GRBL software. The software and the hardware interact via G-code.

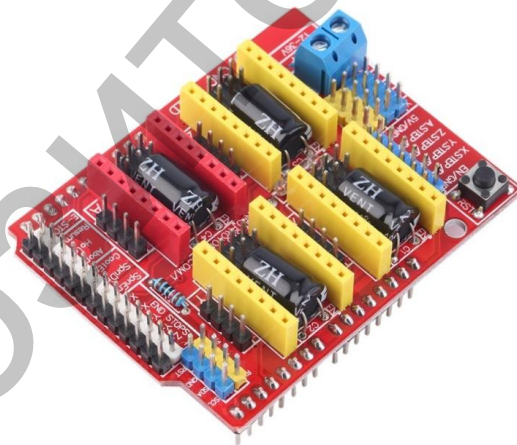


Image 3. CNC Shield v.3.0

**Conclusion.** The results of this search were presented at the 1<sup>st</sup> International contest “The Quality of Education – 2018”. The project won the 1<sup>st</sup> prize.

Reference list:

1. Arduino For Dummies / John Nussey, 2013. – 446 p.
2. Arduino Project Handbook: 25 Practical Projects to Get You Started 1<sup>st</sup> Edition / Mark Geddes, 2016. – 272 p.