



# ANALYSIS OF SIMULATION PROCESSES IN ROBOTICS USING PLATFORMS

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**Annotation.** *This article presents the modeling of simulation processes in robotics using the Tinkercad and Arduino platforms, illustrating methods for simulating the behavior of real technical systems. In addition, the interaction between sensors, actuators, as well as technical and software algorithms, is analyzed during the modeling process.*

**Keywords:** *Arduino, simulation platform, Tinkercad, automation, robotics*

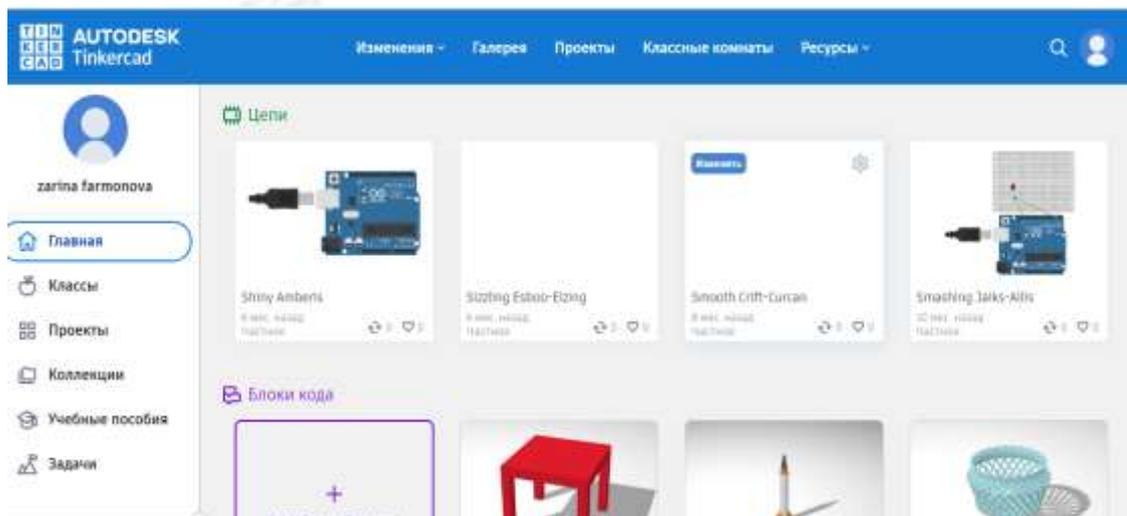
**Introduction.** Today, online platforms have become one of the most effective tools for modeling, testing, and improving technical systems in the fields of industry, automation, robotics, and information technology. Through the modeling of technical processes, it becomes possible to analyze in advance the operating principles of devices, control algorithms, and system responses. From this perspective, the Arduino programming environment and its microcontroller-based boards are widely used as convenient platforms for modeling technical processes. Due to its open architecture, affordability, and ease of programming, Arduino plays an important role in scientific research, educational projects, and the development of practical prototypes.[2]

At the same time, the Arduino programming language and platform can be studied virtually through online simulators that are widely used around the world today. Examples of such simulators include Tinkercad, Open Roberta Lab, Microsoft MakeCode, AI Blocks, ArduBlock, and Modkit.

Tinkercad is an online platform that allows users to create and simulate electronics and robotics projects. For working with Arduino, Tinkercad provides the ability to connect various microcontrollers, sensors, motors, LED lights, and other electronic components, as well as to test programming and control processes.[1]

Main stages of working with Tinkercad and Arduino:

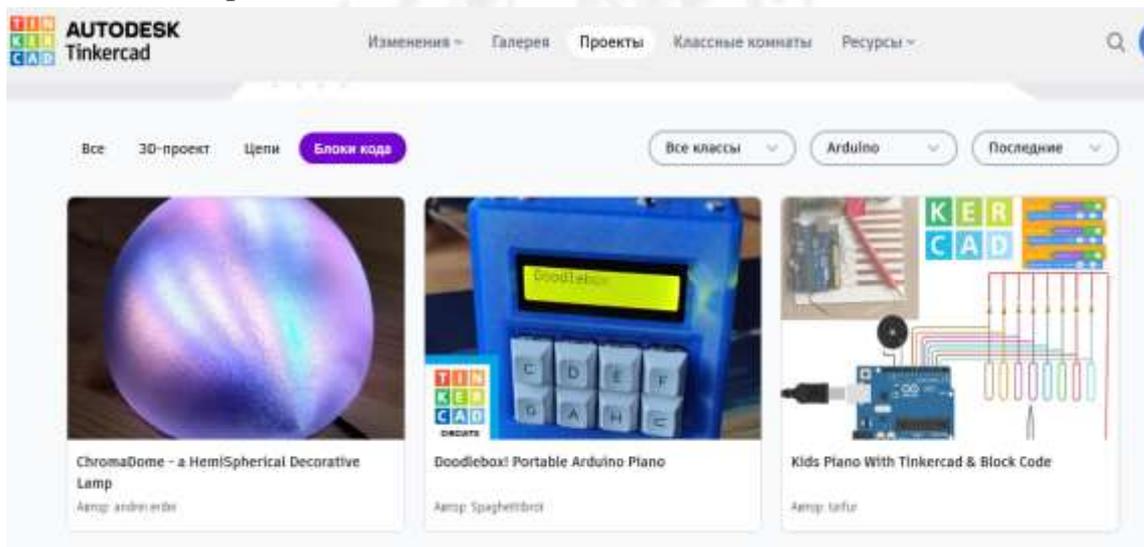
Creating a Tinkercad account: To access Tinkercad, go to the official website and create a new account or log in using your existing account.



1-picture

Creating a new project: To create a new project in Tinkercad, click on the “Create New Circuit” button. This allows you to start building a new electronics project.(1-picture)

Selecting the Arduino board: In the electronics interface of Tinkercad, you can choose the Arduino board. From the “Components” section, select the Arduino Uno board and place it onto the workspace.[4]



2-picture

Adding components: You can add the necessary components for working with Arduino. For example, you may choose LED lights, resistors, capacitors, push buttons, sensors, motors, and other devices. These components can be connected to the Arduino board, preparing the setup for programming and simulation.[3]

**Style and connections:** In Tinkercad, you can use the simulation mode to connect electronic components to each other. To make connections, select the wires tool and attach the necessary components to the appropriate pins. For example, you can connect an LED light to pin 13 of the Arduino board and simulate its behavior to observe the results.

**Programming:** Tinkercad provides two methods for programming the Arduino:



**Coding interface:** If you are familiar with the Arduino IDE language, you can write code in C++ directly in the Tinkercad coding area. The code written here functions the same way as it would on real Arduino boards.

**Block-based programming:**

Tinkercad allows programming the Arduino using a block-based coding system, which is especially useful for those familiar with Scratch or other visual programming languages.

**Simulation:** After writing your program, click the “Simulate” button to test your project. This lets you experiment with the Arduino Uno microcontroller and other components in real time.

For example, if you want to turn on an LED light, you can observe how the LED or other connected devices operate through the simulation.

**Exporting the code:** If your project works successfully, you can export the code to the Arduino IDE. Simply copy the code from Tinkercad and paste it into the Arduino IDE to run it on an actual Arduino board.

**Final testing:** Review your project carefully. If needed, edit the code or connections and run the simulation again to verify performance.

**Advantages of using Tinkercad:** Online and easily accessible: Tinkercad works directly through a web browser on any computer—no additional software installation is required.

**Simulation capability:** Tinkercad allows you to simulate circuits, helping you detect and correct errors quickly in a virtual environment before working with real components.

**Block-based coding:** The support for block-based programming makes it an excellent tool for beginners learning to code.

**Ease of learning:** Tinkercad’s user-friendly and intuitive interface makes it an effective educational tool for teaching Arduino programming and electronics.

In conclusion based on the points above, it can be concluded that the Arduino programming environment and online simulation platforms are among the most convenient and efficient tools for modeling, testing, and developing practical skills in technical processes. Online platforms such as Tinkercad enable users to combine programming, circuit design, and system analysis in one environment. As a result, users not only gain technical knowledge but also develop the ability to apply it practically.

## References

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