

## 7.4 Stepper motor

Stepper motors are a type of electric motor that can precisely control a rotating shaft's angular position. They are the most commonly used type of motor in motion control applications. A stepper motor works by converting electrical pulses into mechanical shaft rotations, which can be used to move a device or position an object. Stepper motors produce precise, smooth, and repeatable motion and can be used in a variety of robotic applications. They are commonly used for positioning CNC machines, 3D printers, pick-and-place systems, and other robotic applications. Stepper motors are available in a variety of sizes and configurations, and can be used with a variety of drive systems and controllers.

In general we differ two types of Stepper motors (regarding the coil wiring):

1. Bipolar Stepper Motor - This type of stepper motor has two sets of coils, each with a single winding per phase. The coils are wired in series or in parallel depending on the application. Each winding in the motor is energized, then de-energized in order to make the motor rotate.
2. Unipolar Stepper Motor - This type of stepper motor has two sets of coils, each with multiple windings per phase. The coils are wired in series or in parallel depending on the application. Only one winding in the motor is energized at a time to make the motor rotate."

### 7.4.1 Task

Stepper motors are used in many Arduino projects to control motion, such as turning a wheel or a motor shaft. By applying pulse-width modulation (PWM) signals, the Arduino can control the speed and direction of the motor. Below is an example of Arduino code that can be used to control a stepper motor:

```
“cpp //Define the pins to be used for the stepper motor #define STEPPER_PIN_1 8 #define STEPPER_PIN_2 9 #define STEPPER_PIN_3 10 #define STEPPER_PIN_4 11

//Define the delay between steps in milliseconds #define STEP_DELAY 10

//Create an array of the pins to be used int pins[]={STEPPER_PIN_1,STEPPER_PIN_2,STEPPER_PIN_3,STEPPER_PIN_4};

//Initialize the stepper motor void setup() { //Set each pin as an output for(int i=0;i<4;i++) { pinMode(pins[i], OUTPUT); } }

//Control the stepper motor void loop() { //Rotate clockwise for(int i=0;i<4;i++) { digitalWrite(pins[i],HIGH); delay(STEP_DELAY); } //Rotate counter-clockwise for(int i=3;i>=0;i--) { digitalWrite(pins[i],HIGH); delay(STEP_DELAY); } }”
```