Using the stepper motor HTML animation

Introduction

It is not always trivial to understand how a stepper motor operates and to get the difference between one phase ON operation, two phases ON, half step, full step, etc. Therefore, a flash animation has been created to help you to understand how a permanent magnet stepper motor operates and have a visual idea of the different operation modes (AN014_Animation_Stepper_Motor.html).

How to use it?

The animation is separated into 3 parts that are explained below (please refer to Figure 1 as well).

Part 1

The inner body of the motor made with 2 phases (A and B) is shown. As it is a permanent magnet technology, the rotor is represented by a pair of pole where the north is red and the south is green. When the windings are energized, it can be considered that the stator is also acting as a pair of poles and therefore it will be colored in red and green. When a winding is not energized, it stays black and the stator which is not acting as a pair of pole stays grey.

Part 2

To make a stepper motor rotate, one has to energize the two phases (meaning the windings) by respecting a precise sequence. This sequence is represented in the phase diagram where the current in both phases is plotted.

Part 3

This part is the first one where the user can interact with the animation. 4 different step modes can be chosen: *full step 1 phase ON, full step 2 phases ON, half step* and *micro step*. When a button is selected its background turns green. *Full step 1 phase ON* is the default selection, meaning that only one phase at the time will be energized. This can be seen in the diagram of part 2, if phase A is energized, phase B is not and vice versa.
The user may choose to operate in half step (rotor moving by half step) and micro step (rotor moving by 1/8th of a step)

In order to see the rotation of the motor, the user has two choices: *Single step* andC*continuous run*.
Once the user has set the operation mode in the part 3, the motor can be operated step by step manually (by clicking on the “Step CW” button) or automatically by setting a speed with the slider then pressing the “Run” button. The motor can be stopped with the “Stop” button.

Hints

- Stepper motors are electronically commutated (EC) synchronous motors: the direction of rotation and speed only depend on the commutation sequence of the two phases.
- The sequence of 4 different statuses (in full step mode) can easily be achieved with simple electronics. Stepper motors are very easy to control.

- Since they are EC, there isn't any brush that wears and limits the lifetime.
- Pay attention to the different current level in *Half-step* mode. A motor operating with *2-Phase ON* delivers √2 times more torque than in *1-Phase ON* with the same current per phase. Hence, with *Half step* mode which is the alternation of those two modes, it is advised to adjust currents by √2 every half-step.
- It is noticeable with this animation that running the motor in *Micro step* mode creates a smoother motion. Besides increased resolution, this is the main benefit of *Micro step.*

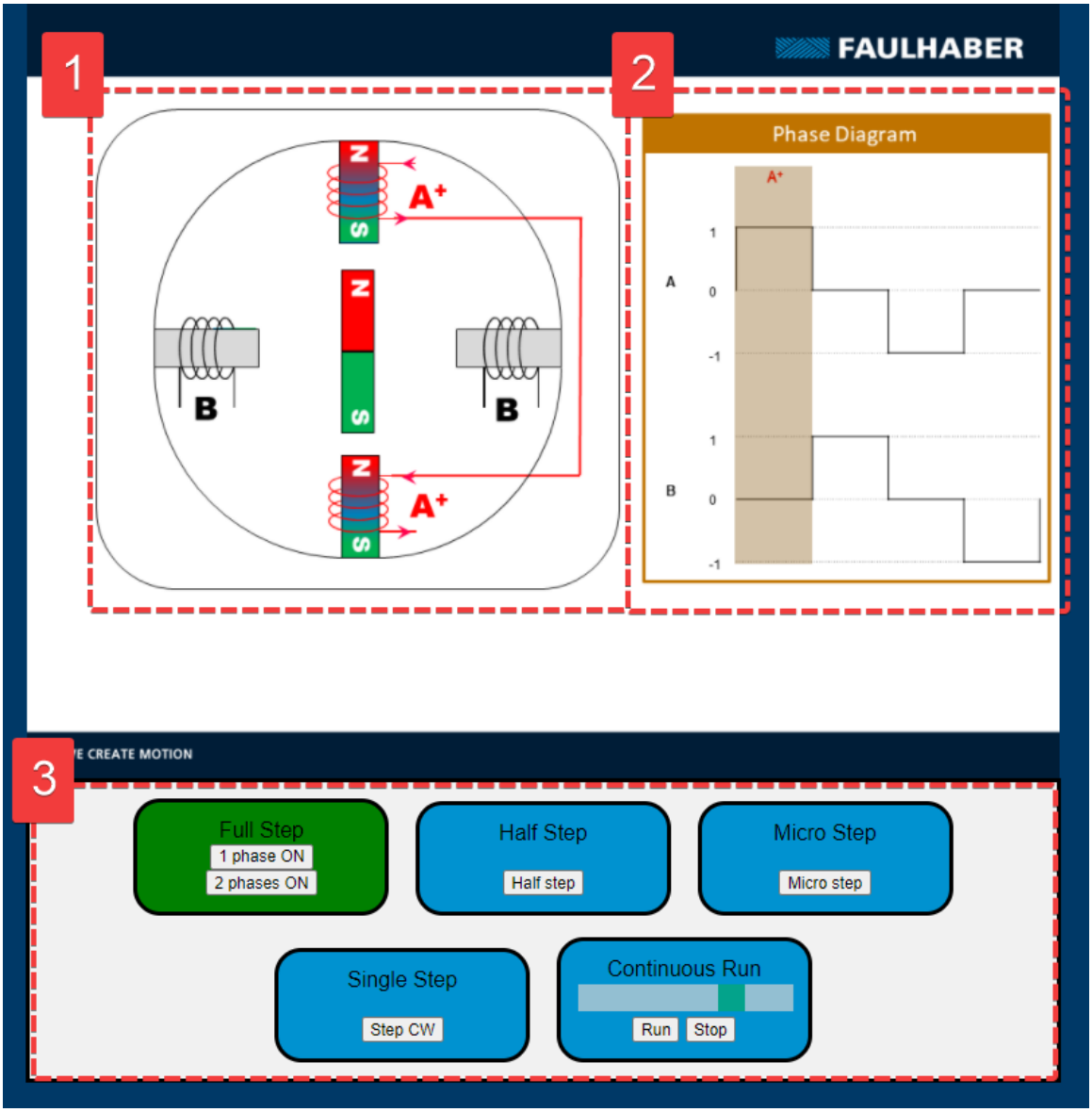

Figure 1 : Stepper motor animation interface.

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