TECHNISCHE UNIVERSITÄT WIEN

Institut für Computertechnik
Institute of Computer Technology

MELODI

Mass E-Learning of design, test, and prototyping DIgital hardware

LEVEL 2

Stepper: Spin the disk!

In this task, you need to control a stepper motor on which a disk is mounted that indicates the rotation.

Stepper motor control info: The characteristics are the direction of rotation, the angle of rotation and the angular velocity. The coils of the stepper motors are directly controlled via an output pin unipolar. *Figure 1* schematically shows an unipolar circuit of a stepper motor. The coils must be controlled one after the other in the desired direction in order to turn the rotor of the motor one step further. Such a control generates full steps (see *Table 1* and *Figure 2*).

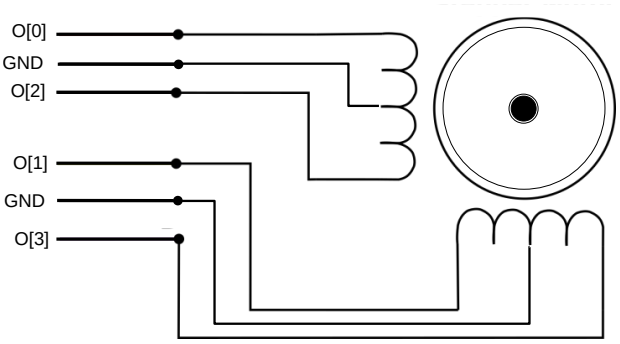

Figure 1: Stepper coils.

Your task now is to create output signals that cause a permanent rotation of the stepper motor according to *Table 1* and *Figure 2*. The **stepping frequency** must be **100Hz**. As the coils might start overheating due to a long active output signal, the outputs must not be driven with a continuous HIGH signal but with a PWM signal. For this purpose, a **PWM** with a frequency of **4kHz** and a duty cycle of **20%** must be generated at any active output.

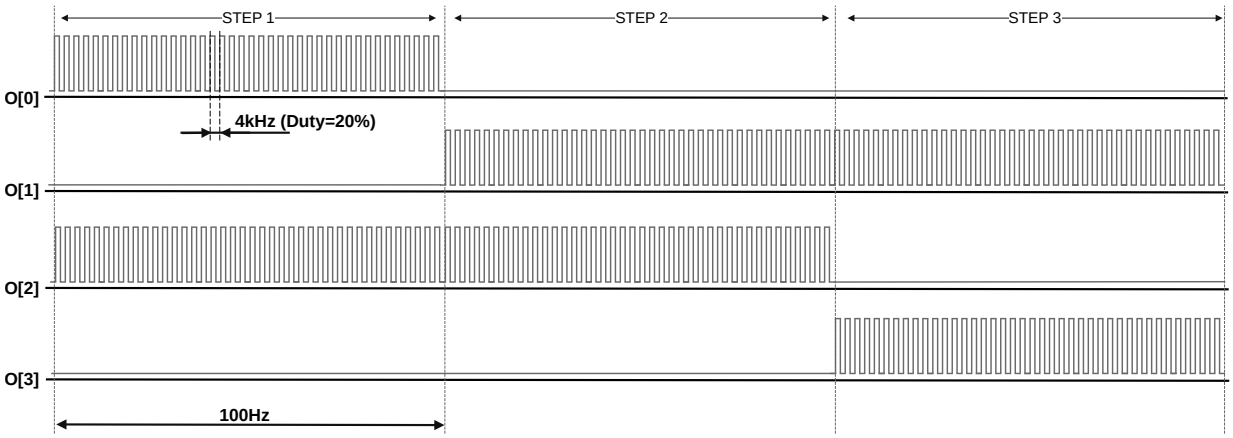

Figure 2: Details of the PWM timing.

Step	**O[0]**	**O[1]**	**O[2]**	**O[3]**
1	PWM	(low)	PWM	(low)
2	(low)	PWM	PWM	(low)
3	(low)	PWM	(low)	PWM
4	PWM	(low)	(low)	PWM
1	PWM	(low)	PWM	(low)
...	...	...	...	...

Table 1: Unipolar stepper control.

Entity

The entity "stepper_motor" entity is declared in the attached file "stepper_motor.vhdl" and has the following properties:

- Input: CLK (100MHz) with type std_logic
- Output: O with type std_logic_vector of length 4

Do not change the file "stepper_motor.vhdl". The above mentioned behavior has to be programmed in the attached file "stepper_motor_beh.vhdl".

HINT: The feedback from MELODI tells you whether the initial steps was reached as well as every finished step. If your output behaviour differs from the desired one, this could be due to a wrong PWM period or duty cycle or due to a wrong output for the current step.

To turn in your solution write an email to vhdlabgabe+e384@tuwien.ac.at with subject "Result Task 2" and attach your behavior file(s):

- "stepper_motor_beh.vhdl"

Good Luck and May the Force be with you.