1.DC Motor First Principle

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1-1. Equivalent moment of Inertia

$$J_{eq} = J_m + J_h + J_d$$

1-1) Given, $J_m = (4.0 \times 10^{-6})\ kg \cdot m^2$

$r_h = 0.0111\ m$; $r_d = 0.0248\ m$

$m_h = 0.0106\ kg$; $m_d = 0.053\ kg$

$$J_{eq} = J_m + J_h + J_d$$

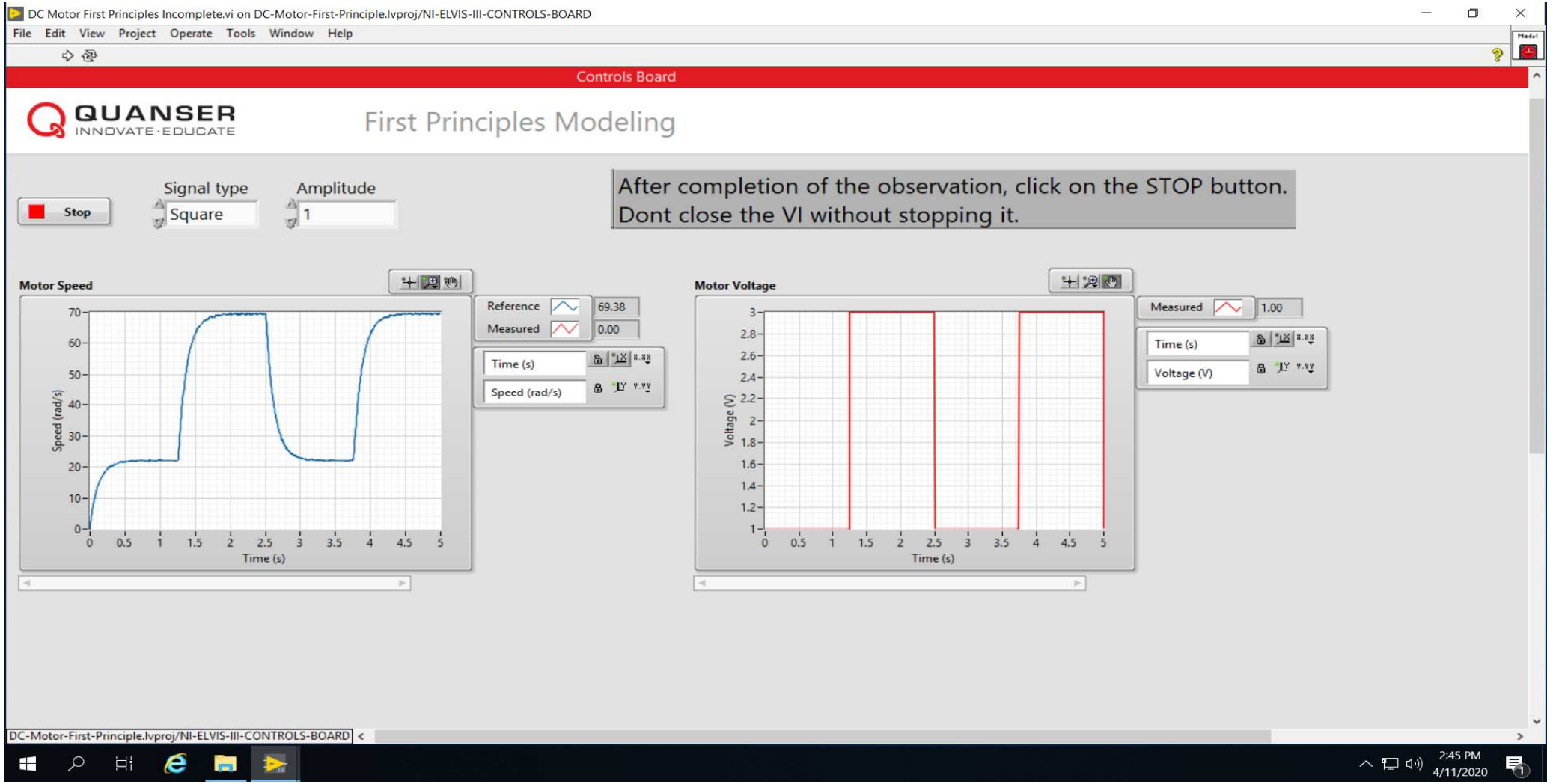
$$= (J_m) + \left(\frac{1}{2} \times m_h \times r_h^2\right) + \left(\frac{1}{2} \times m_d \times r_d^2\right)$$

$$= (4 \times 10^{-6}) + \left(\frac{1}{2} \times 0.0106\right) \times (0.0111)^2$$

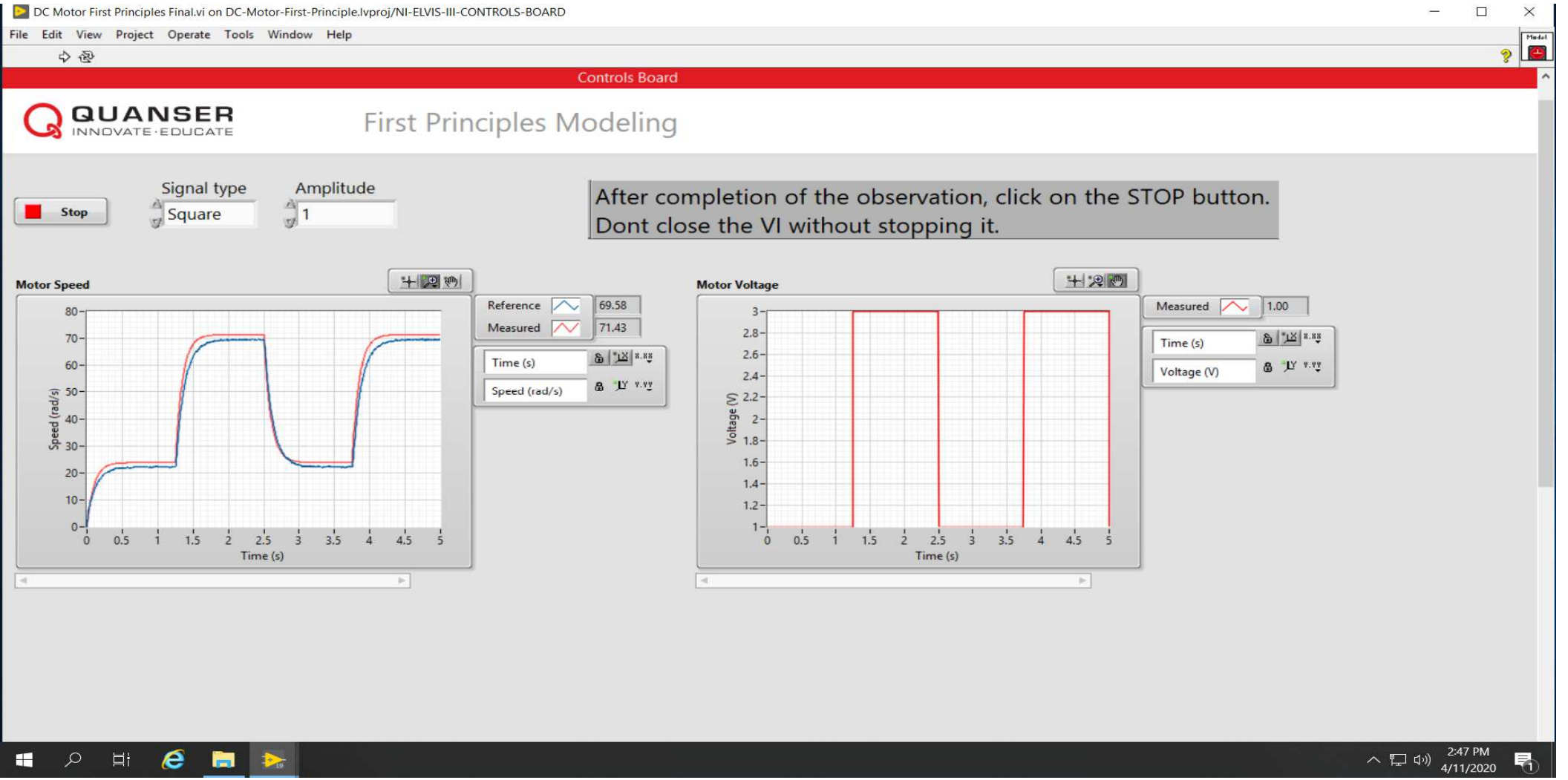
$$+ \left(\frac{1}{2} \times 0.053 \times (0.0248)^2\right)$$

$$\boxed{J_{eq} = (2.0951 \times 10^{-5})\ kg \cdot m^2}$$

1-2 Attach the screen capture you saved in Step 4.



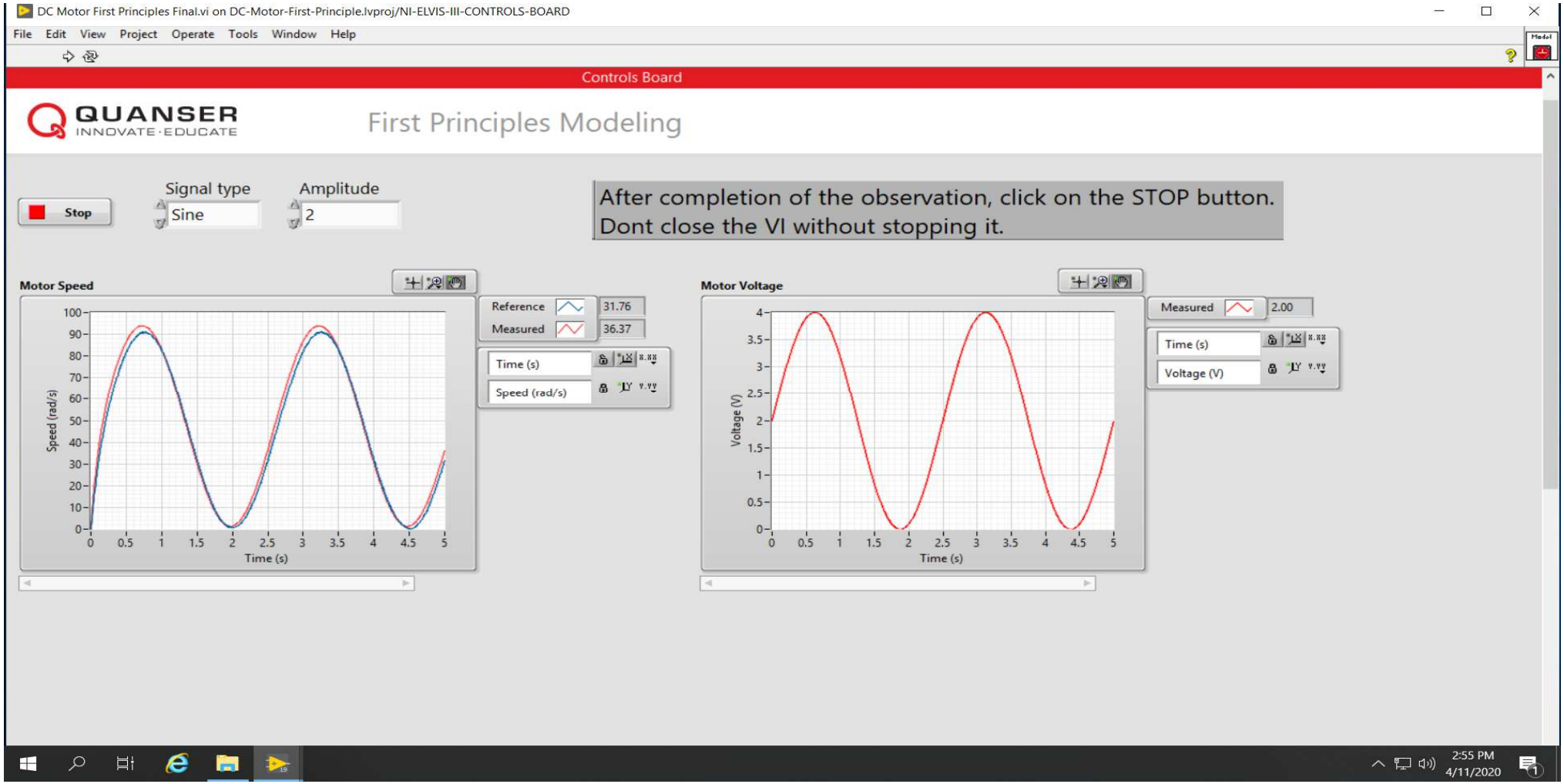
1-2 Contd.. (comparing actual with model)



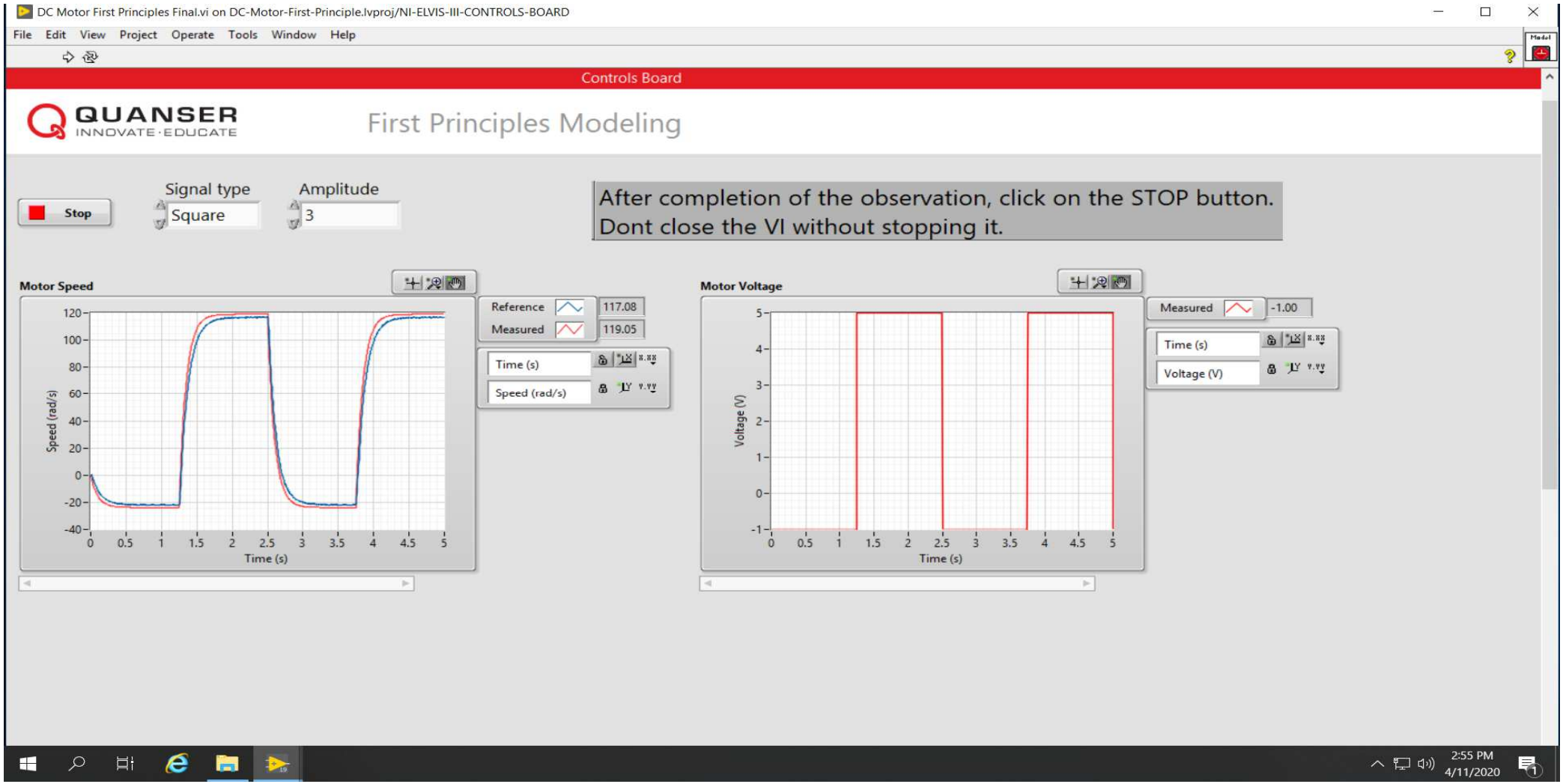
1.2.1

Signal Type	Amplitude of the Signal	Peak Speed (rad/s)
Sine	2	93.88
Square	3	120
Saw tooth	4	120.8
Random	5	82.45

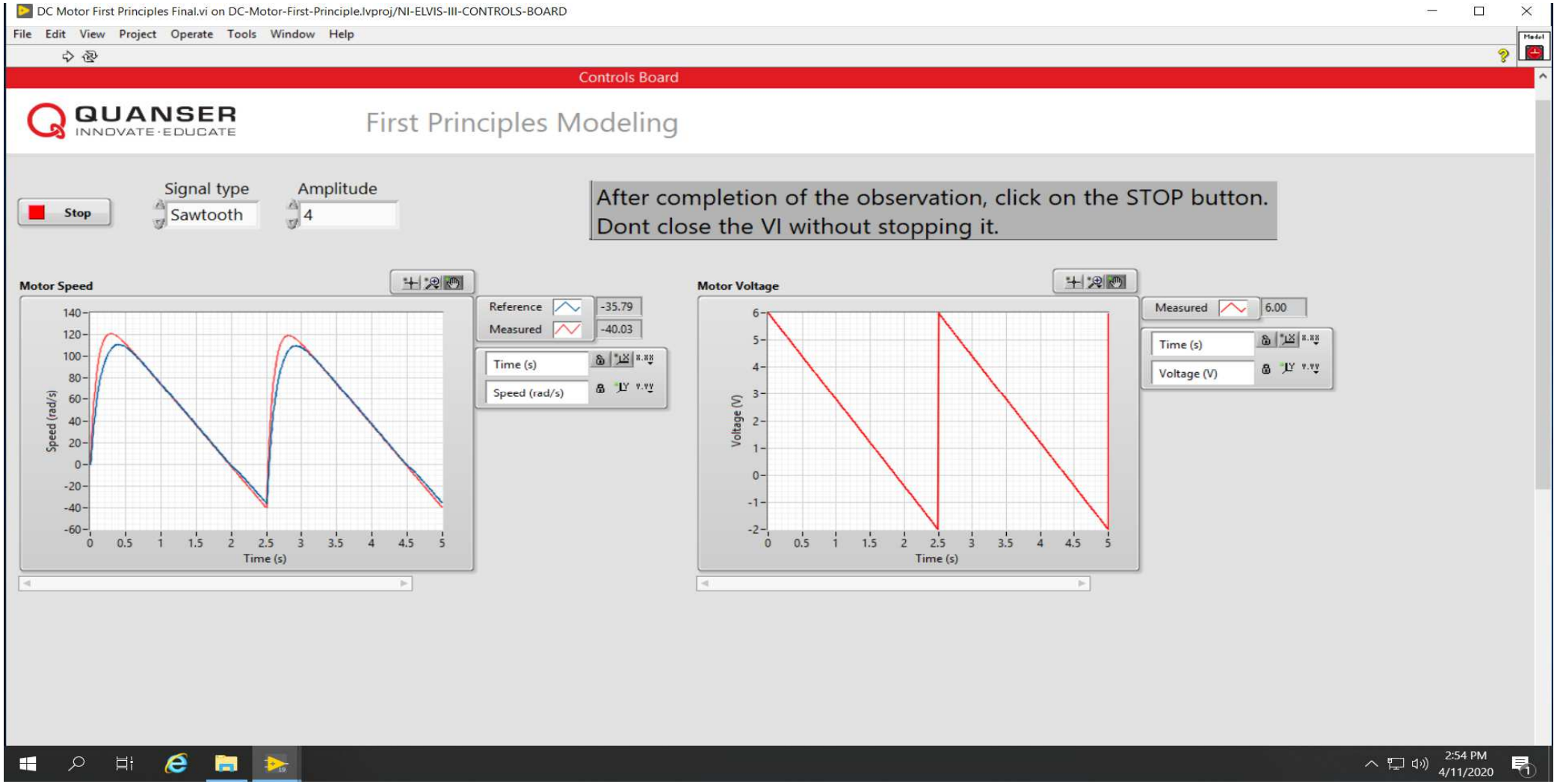
1.2.2 Sine with amplitude 2



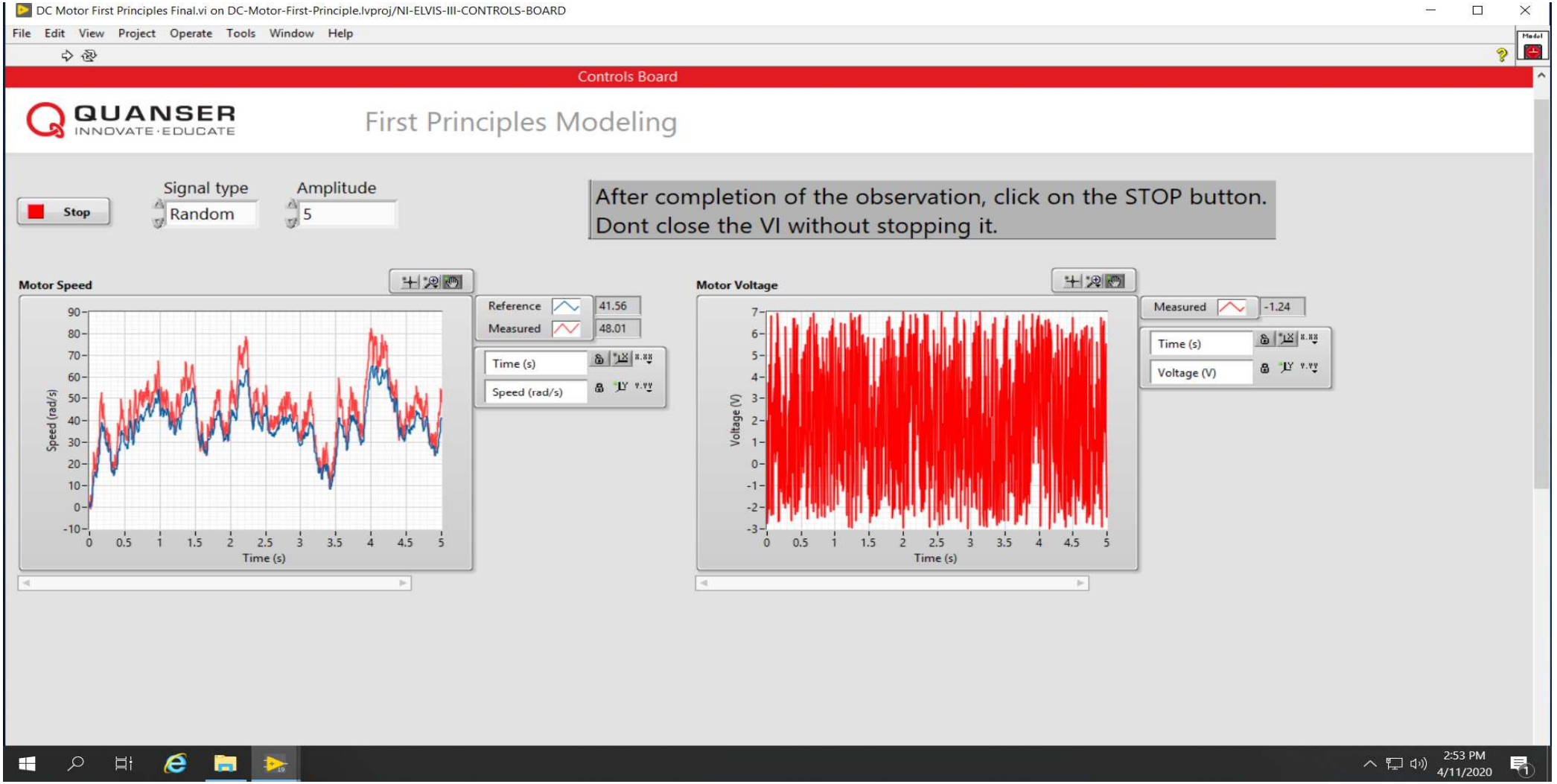
1.2.2 Square with amplitude 3



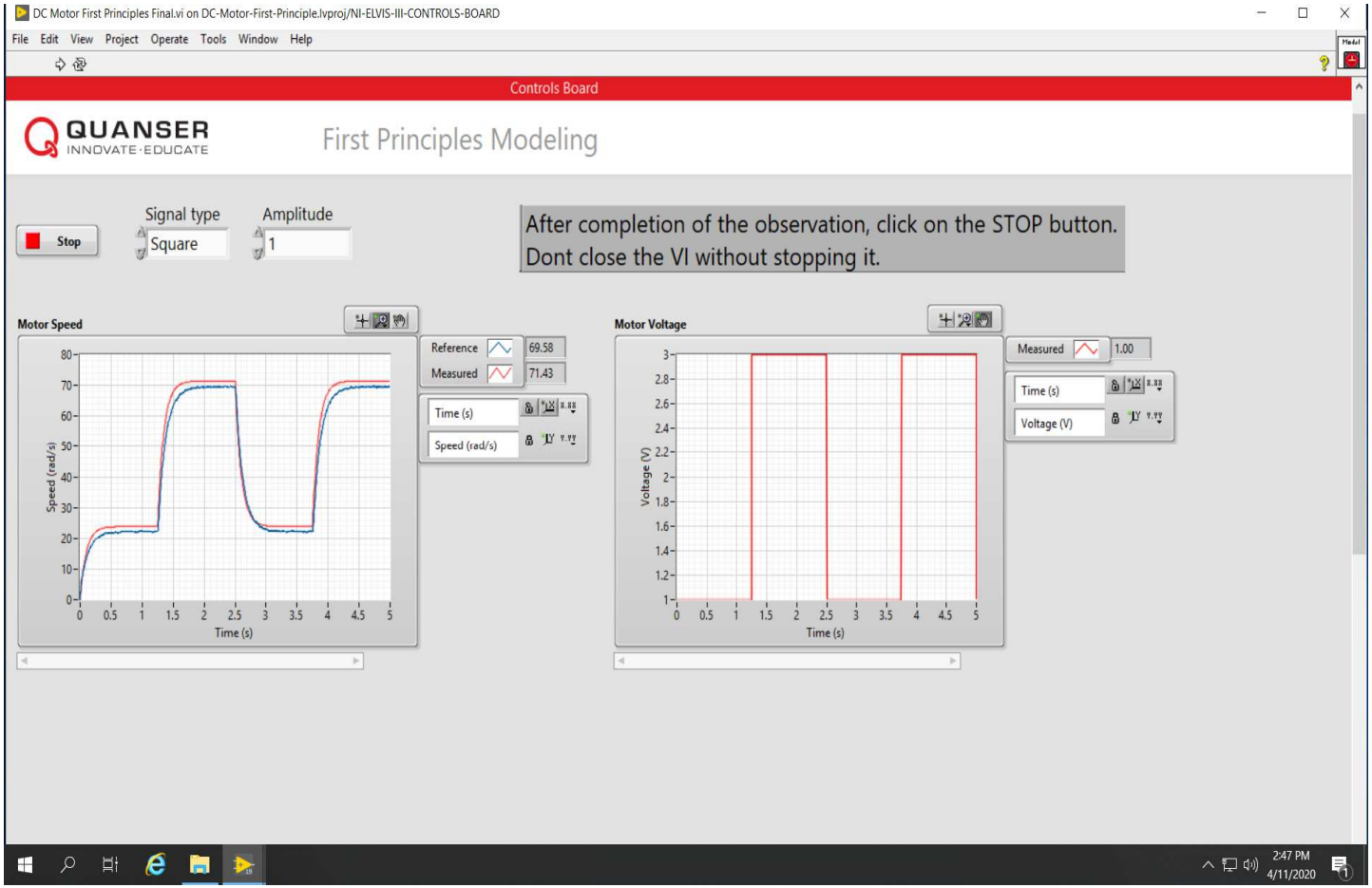
1.2.2 Sawtooth with amplitude 4



1.2.2 Random signal with amplitude 5



1.3 What is the offset voltage of the system after running the final VI (step 6)?



OFFSET VOLATGE = 1V

1-4 Transfer Function parameters

$$\text{Transfer function} \rightarrow \frac{\Omega_m(s)}{V_m(s)} = \frac{\frac{1}{K_m}}{\frac{J_{eq} R_m}{K_t K_m} s + 1}$$

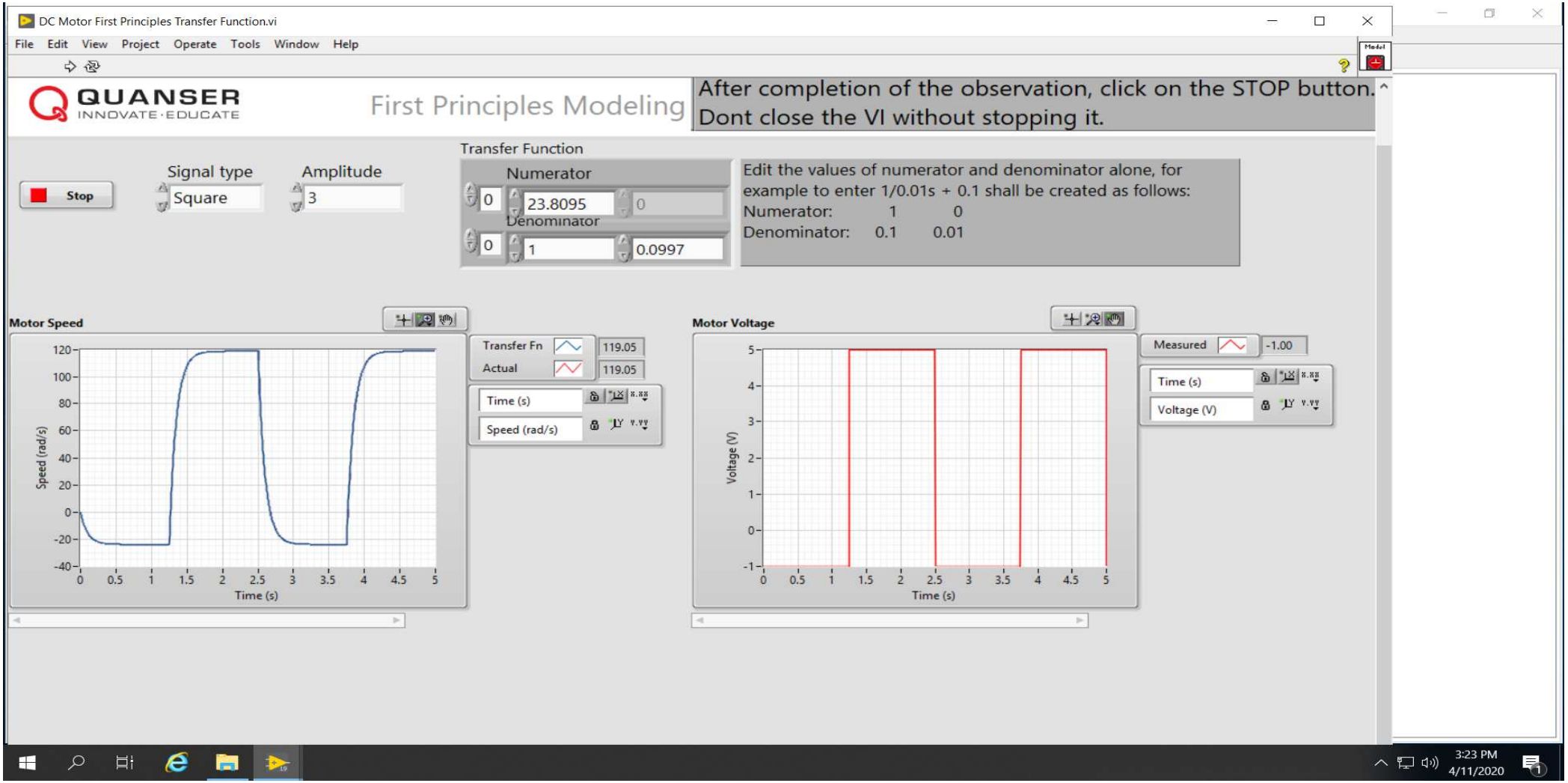
Substituting, $K_m = 0.042\ V/(rad/s)$

$J_{eq} = 2.0951 \times 10^{-5}\ kg \cdot m^2$

$R_m = 8.4\ \Omega$

$K_t = 0.042\ N \cdot m/A$

$$\Rightarrow \boxed{\frac{\Omega_m(s)}{V_m(s)} = \frac{23.8095}{0.0997s + 1}}$$



Note : Transfer function output exactly coincided with actual value. Hence red waveform is not visible.