

# **IMPLEMENTATION OF BOOST CONVERTER TO THE EXISTING MICRO - SAVONIUS VERTICAL AXIS WIND TURBINE (VAWT)**

**STUDENT : NURSYUKRIAH BINTI IDRIS**

**STUDENT ID : B13KE0043**

**SUPERVISOR : DR NORZANAH BINTI ROSMIN**

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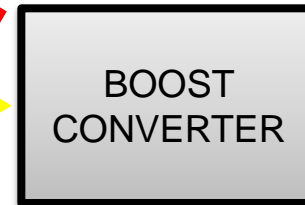
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# INTRODUCTION



Existing Micro - Savonius VAWT



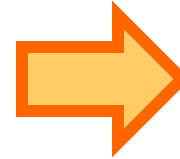
DC Load  
(Miniature Light Bulb)

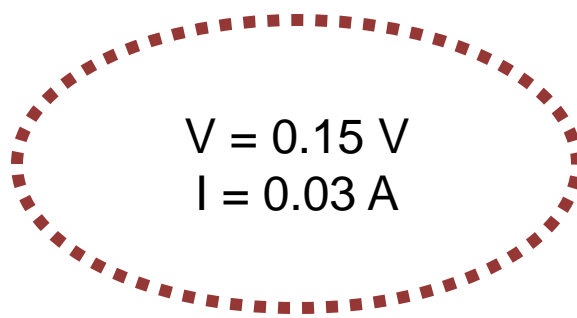


- Used the blow of wind to generate electricity
- Harnessed the wind blow from the air compressor of air conditioner
- Environmental friendly – does not produce air pollution

# PROBLEM STATEMENT

The existing micro-savonius VAWT developed by Dygku. Asmanissa Binti Awg. Osman [1] generates small power output




$$V = 0.15 \text{ V}$$
$$I = 0.03 \text{ A}$$

No support in terms of power converter part in the previous student's design in order to increase the power output's performance

# OBJECTIVES

1

To design and simulate a boost converter for the existing micro savonious VAWT system using Matlab/Simulink software

2

To develop and fabricate the boost converter for the proposed VAWT system

3

To analyze and compare the results obtained from the simulation and hardware

# SCOPE OF WORK

Use the air flow from air compressor of air conditioner that are installed at P16 FKE to rotate the rotor of the turbine

Considered load:

Miniature Light Bulb;

$$V = 1.5 \text{ V}$$

$$I = 0.3 \text{ A}$$

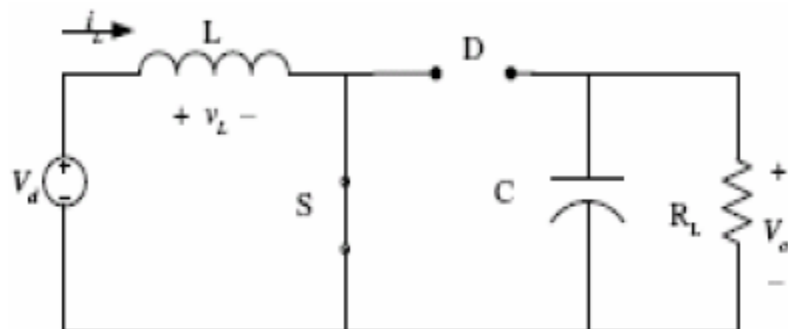
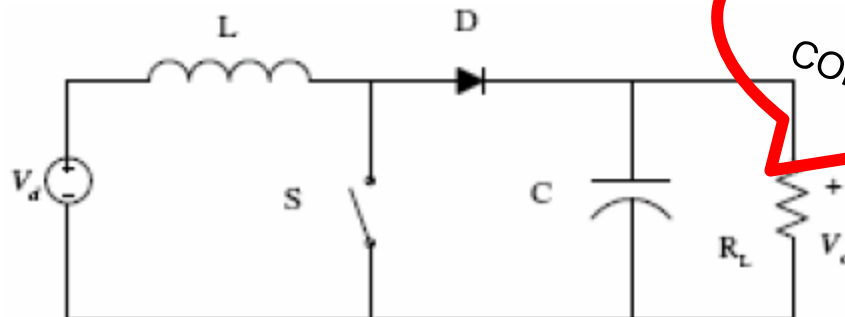
Considering:

Simulation  
(MATLAB/Simulink)

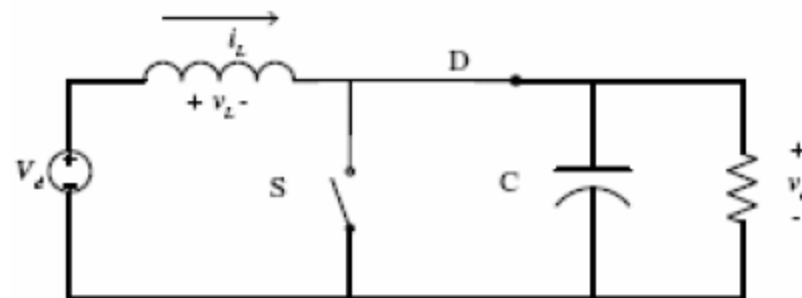
Hardware  
implementation

# LITERATURE REVIEW

Boost converter output voltage always greater than its input voltage



When the **switch is closed**, the energy is stored in the magnetic field of the inductor ( $L$ ).  
The current ( $i_L$ ) flows in the inductor ( $L$ ) and the voltage ( $v_L$ ) across the inductor is equal to the input voltage ( $V_d$ )



When the **switch is opened**, the energy stored in the inductor is transferred to the capacitor ( $C$ ) and the load ( $R$ ) through the diode ( $D$ ). The voltage ( $v_L$ ) across the inductor reverses and add to the input voltage ( $V_d$ ) to increase the output voltage ( $V_o$ )

# LITERATURE REVIEW (cont.)

**TABLE 1**

TITLE	AUTHOR	OBJECTIVE	FINDING/ANALYSIS
<b>Savonius Wind Turbine Performances On Wind Concentrator</b>	Dygku. Asmanissa Binti Awg. Osman	This project present the performances of two different type of savonius VAWT blade rotors with and without using a wind concentrator in term of angular speed ( $\omega$ ), power coefficient (CP), torque coefficient (CT) and tip speed ratio (TSR)	The best performances were achieved from the testing of the conventional savonius VAWT which gave some higher performances in every testing conducted compared to the performances of the helical savonius VAWT. The increasing speed of winds will influence the performances of both savonius VAWT blade rotors.
<b>Performance Of Savonius-Darrieus Type Of Vertical Axis Wind Turbine</b>	Nur Azrina Binti Mohd Azman	This project is conducted to design and develop micro-sized vertical axis wind turbine (VAWT) system using conventional Savonius and modified Savonius-Darrieus (Mod-SD) blades with comparison in terms of efficiency and power performance	The Mod-SD gave better performance compared to the conventional in terms of generated output power, speed rotation and efficiency. VAWT system can be improved by considering trade-off between conventional Savonius and Darrieus advantages.
<b>Comparison Performance Of Vertical Axis Wind Turbines Without And With Guide Vane Sourced By Air Flow Of Air Compressor</b>	Umi Amirah Binti Azhar	A micro VAWT system with guide vane was designed and had tested with four criterions; blade design, point of testing, slanted angle and without and with concentrator. The comparison had been made in terms of rotational blade speed, generated power and the power coefficient	The modified Savonius blade turbine presents the highest output power and power coefficient, which are 5.1246 mW and 0.41, respectively. Besides, power can be generated better at Point A compared to Point B. Slanted angle of 30° and application of concentrator also contribute for a better VAWT performance in terms of rotational blade speed, generated power and the power coefficient
<b>Improving The Performance Of Micro-Sized Vertical Axis Wind Turbine Using Deflector Plate And End Plate</b>	Nur 'Aliah 'Iffah Binti Rosli	This project studied the relationship between the performance of micro sized vertical axis wind turbine and the augmented techniques; deflector plate and end plate	The performance of the VAWT system in terms of tip speed ratio (TSR) and the power coefficient (Cp) had improved by the assistance of augmented techniques



# LITERATURE REVIEW (cont.)

TABLE 2

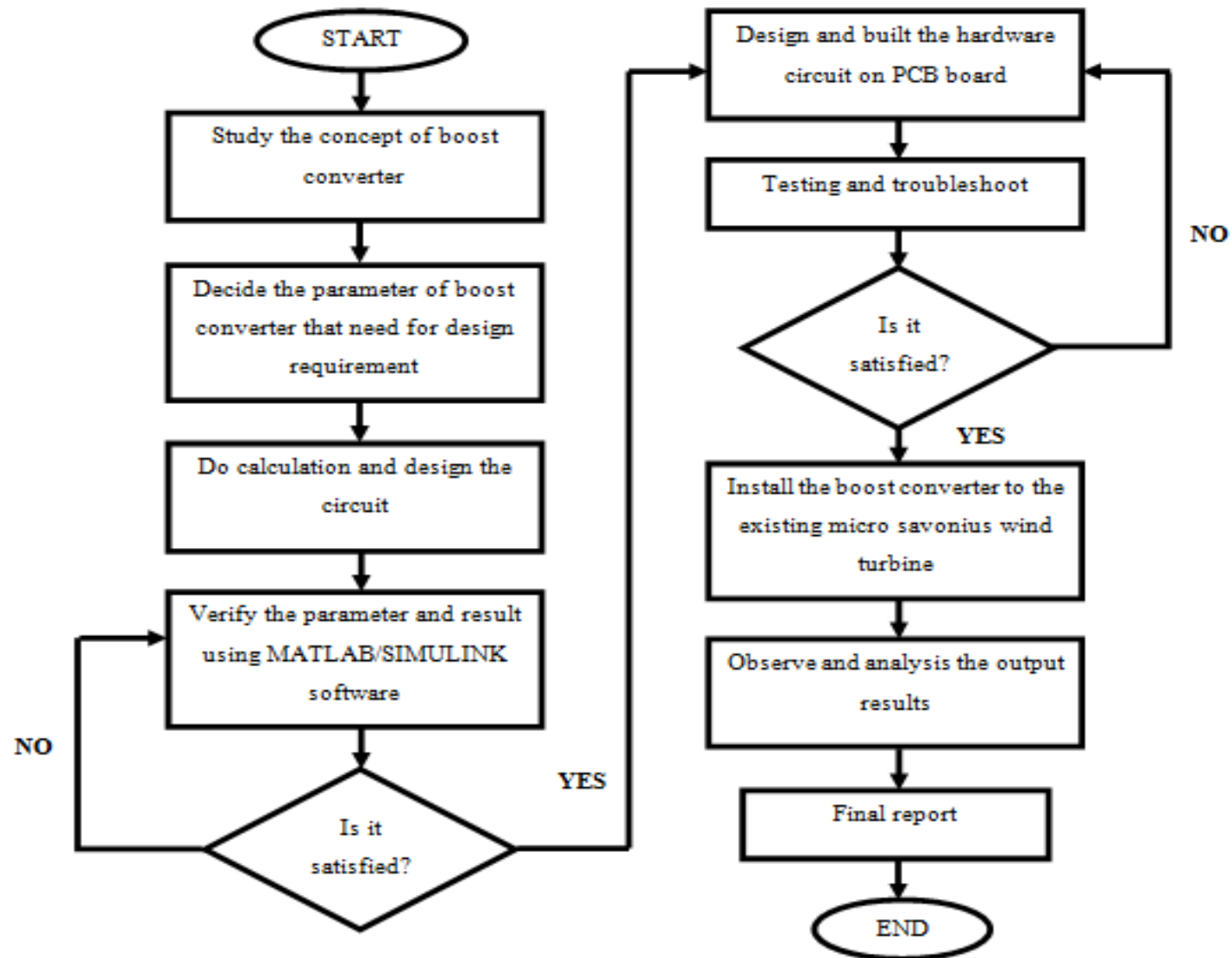
TITLE	AUTHOR (YEAR)	OBJECTIVE	FINDING/ANALYSIS
<b>Boost Converter Design with Stable Output Voltage for Wave Energy Conversion System</b>	Khalid. H. Mohamed, Taib B. Ibrahim and Nordin B. Saad (2013)	This paper presents the design and simulation of a boost converter for a Wave Energy Conversion System (WECS) which the converter is designed to ensure the output voltage of WECS will be boosted up from a variable input voltage to a stable output voltage	The simulation models have been developed and tested in the Matlab/Simulink. Simulation result has proven that, the proposed design is able to produce a constant output voltage from variable input voltage
<b>Constant Output Under Transient Condition in Wind Turbine using Novel Boost Converter</b>	S.Bhagawath and Dr.S.Edward Rajan (2013)	This paper investigates how the output is being constant in the variable voltage condition of the wind turbine by using the boost converter and the selected parameters	By this novel technique, the switching losses are reduced and obtained high voltage. Apart from that the proposed converter is identified as highly suited for DC Wind turbine system to enable, the control of current in to a constant load, as well as in to grid
<b>Efficiency Analysis of Power Converters for Urban Wind Turbine Applications</b>	A. Stabile, A. J. Marques Cardoso, C. Boccaletti (2010)	To determine which power converter is more suitable for a small urban wind application since the urban environment is characterized by multidirectional winds with a wide speed range	All the power converter topologies; buck-boost, boost and back-to-back are very well suited for the specific application, however, they have been compared in term of the number of active components, the overload capabilities and the amount of losses (efficiency), at different speed levels

# SUMMARY/GAP FROM LITERATURE REVIEW

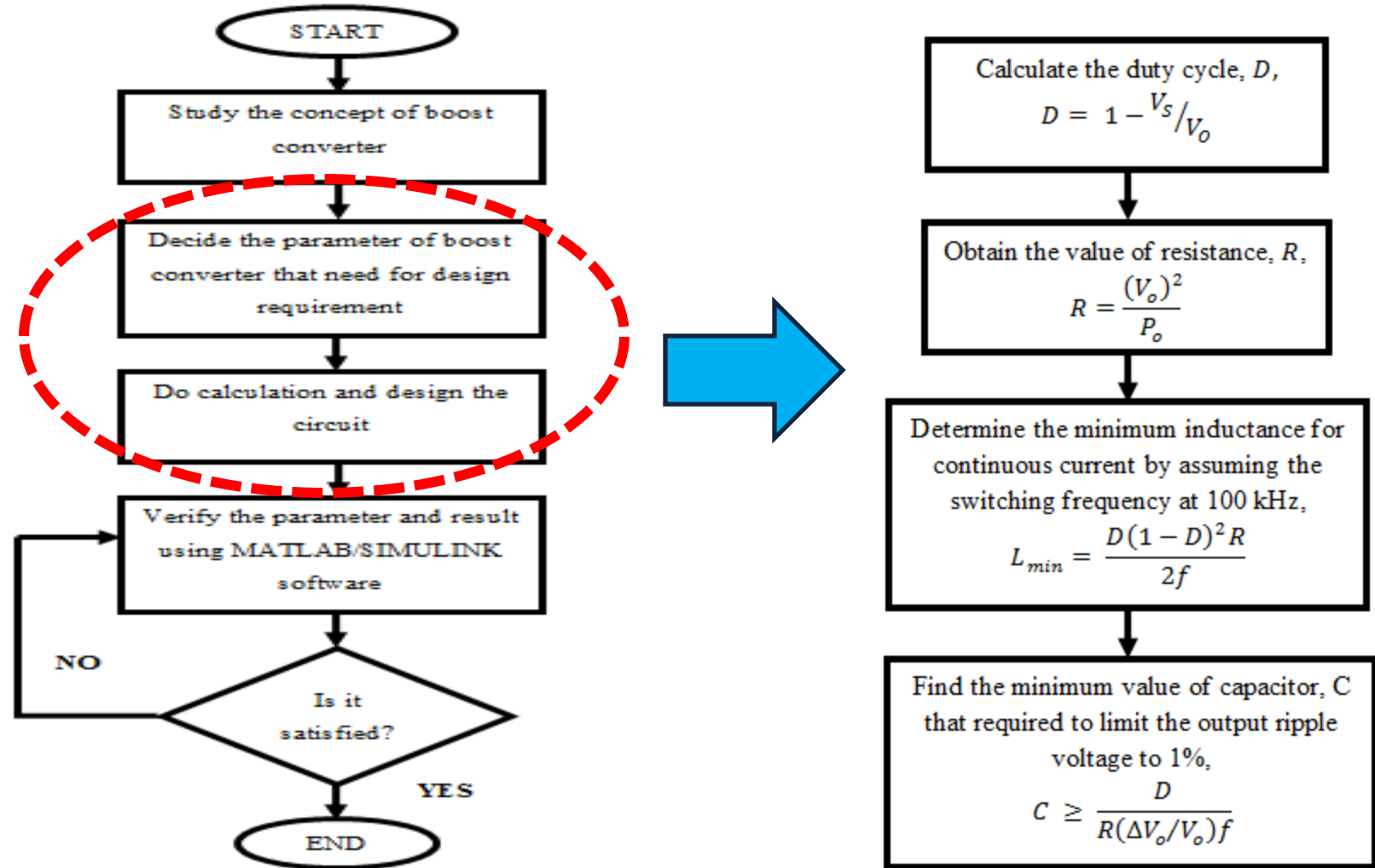
From **TABLE 1**,  
no work  
considered  
power  
converter

From **TABLE 2**,  
boost converter  
generally used  
to boost up the  
voltage and  
current

# METHODOLOGY



# FLOWCHART



# GANTT CHART

## Gantt Chart for Semester 1

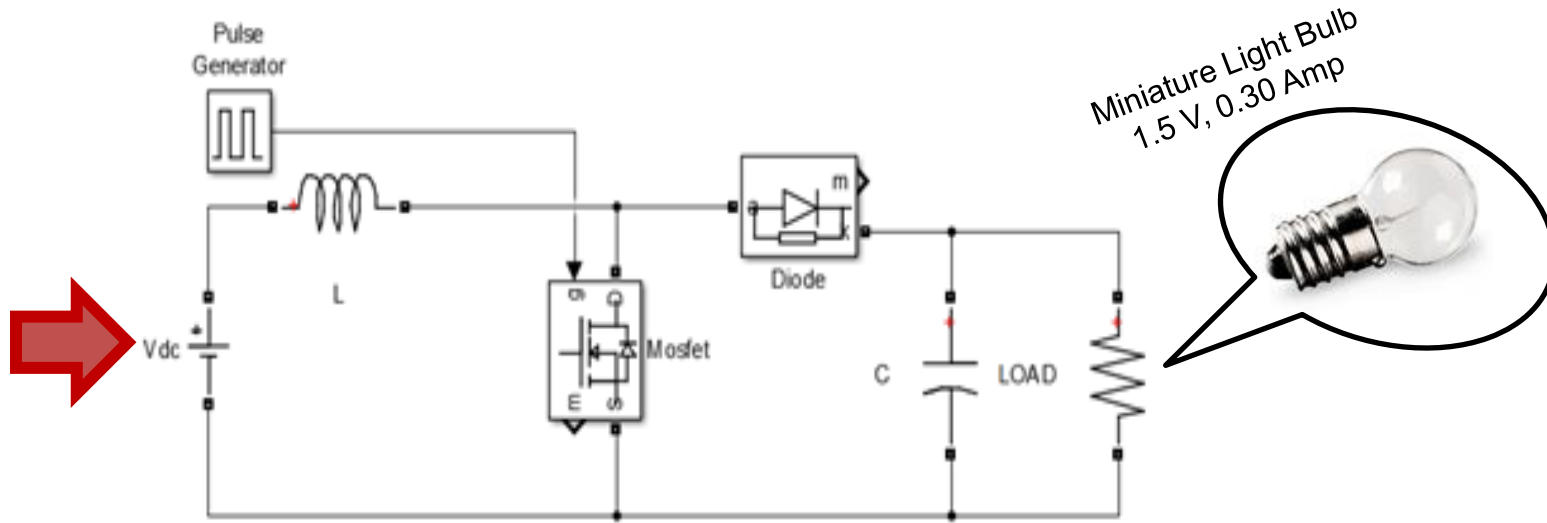
ACTIVITIES/WEEKS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Decide Topic	■	■	■	■												
Analyze Topic			■	■	■	■	■	■								
Literature Review					■	■	■	■	■	■	■	■	■			
Project Proposal						■	■	■	■							
Design and Simulation									■	■	■	■	■	■		
Seminar Presentation															■	
FYP 1 Project Report																■

## Gantt Chart for Semester 2

ACTIVITIES/WEEKS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Development of Hardware	■	■	■	■	■	■	■												
Testing and Verification						■	■	■	■	■	■	■	■						
Troubleshooting and Collecting Data									■	■	■	■	■	■					
Final Seminar Presentation															■				
Final Thesis Draft													■	■	■	■	■	■	
Thesis Submission																			■

# PRELIMINARY RESULT

Output voltage  
of 0.15 V from  
micro-savonius  
VAWT entering  
boost  
converter



DC sources,  $V_{dc} = 0.15V$

Duty ratio,  $D = 0.9$

Load resistance,  $R = 5\Omega$

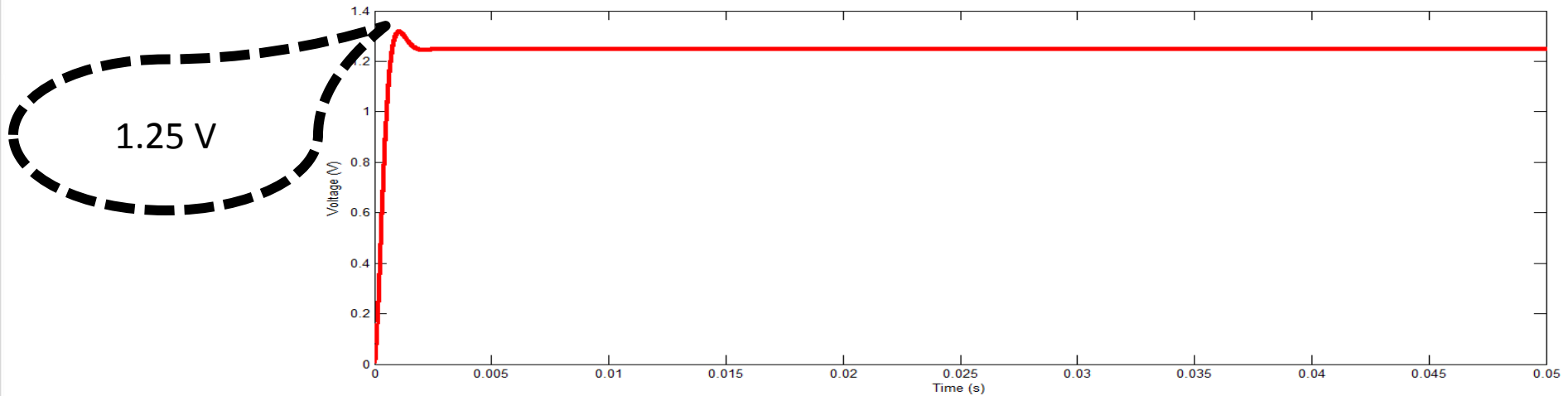
Assume  $f = 100k$ ,  $L_{min} = 225nH$

In practical, the value of inductor,  $L$  must be 25% greater than  $L_{min}$ .

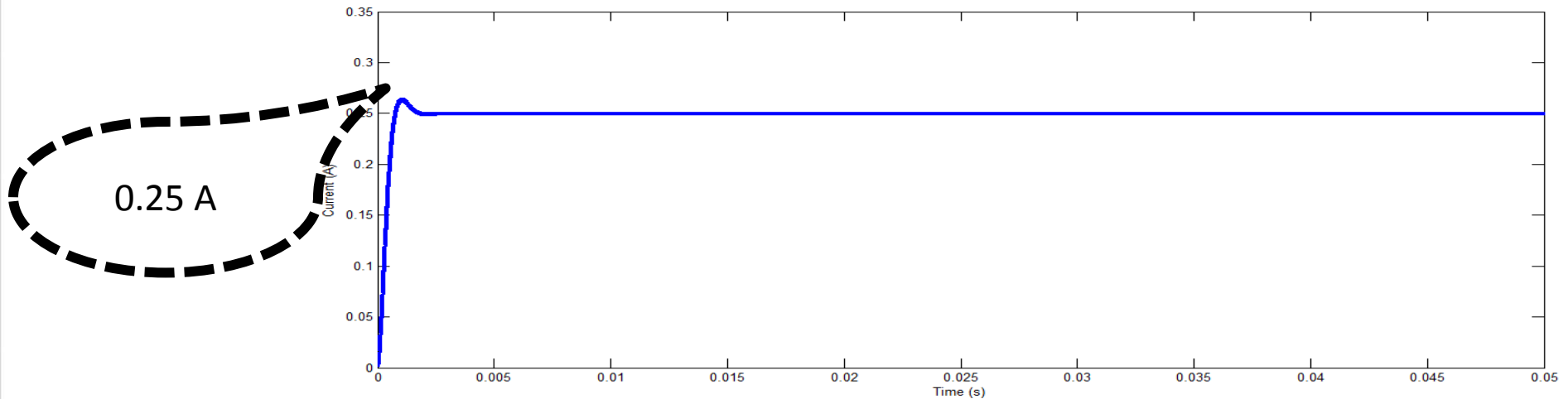
Therefore,  $L = 281.25nH$

Capacitance,  $C = 180\mu F$

- Output Voltage of Boost Converter



- Output Current of Boost Converter



# EXPECTED OUTCOME

The proposed DC-DC boost converter circuit can be designed and developed using Matlab/Simulink software



The proposed converter can be implemented in a real hardware



The entire proposed system performance can be improved; voltage and current



The proposed converter hardware can be applied to the proposed VAWT system



# REFERENCES

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**THANK YOU**  
**Q & A**





# WIND ENERGY APPLICATION

