THREE-PHASE CONTROLLED RECTIFIER CIRCUIT PROJECT

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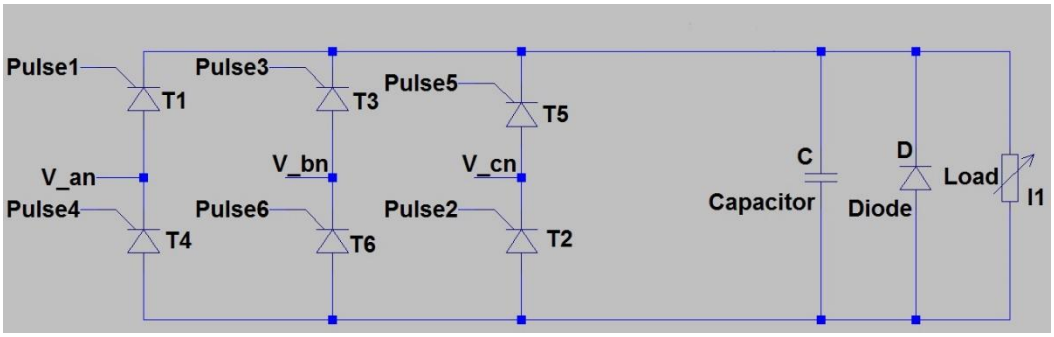
Abstract
This project investigates a three-phase controlled rectifier circuit using MATLAB/Simulink. The circuit comprises a three-phase source, six thyristors, a six-pulse configuration, a filtering capacitor, a diode for rectification, and a resistive load. Through mathematical modeling and simulations, the study explores the circuit's behavior under varying conditions. The project aims to analyze performance characteristics and efficiency, providing valuable insights for practical applications in power electronics.

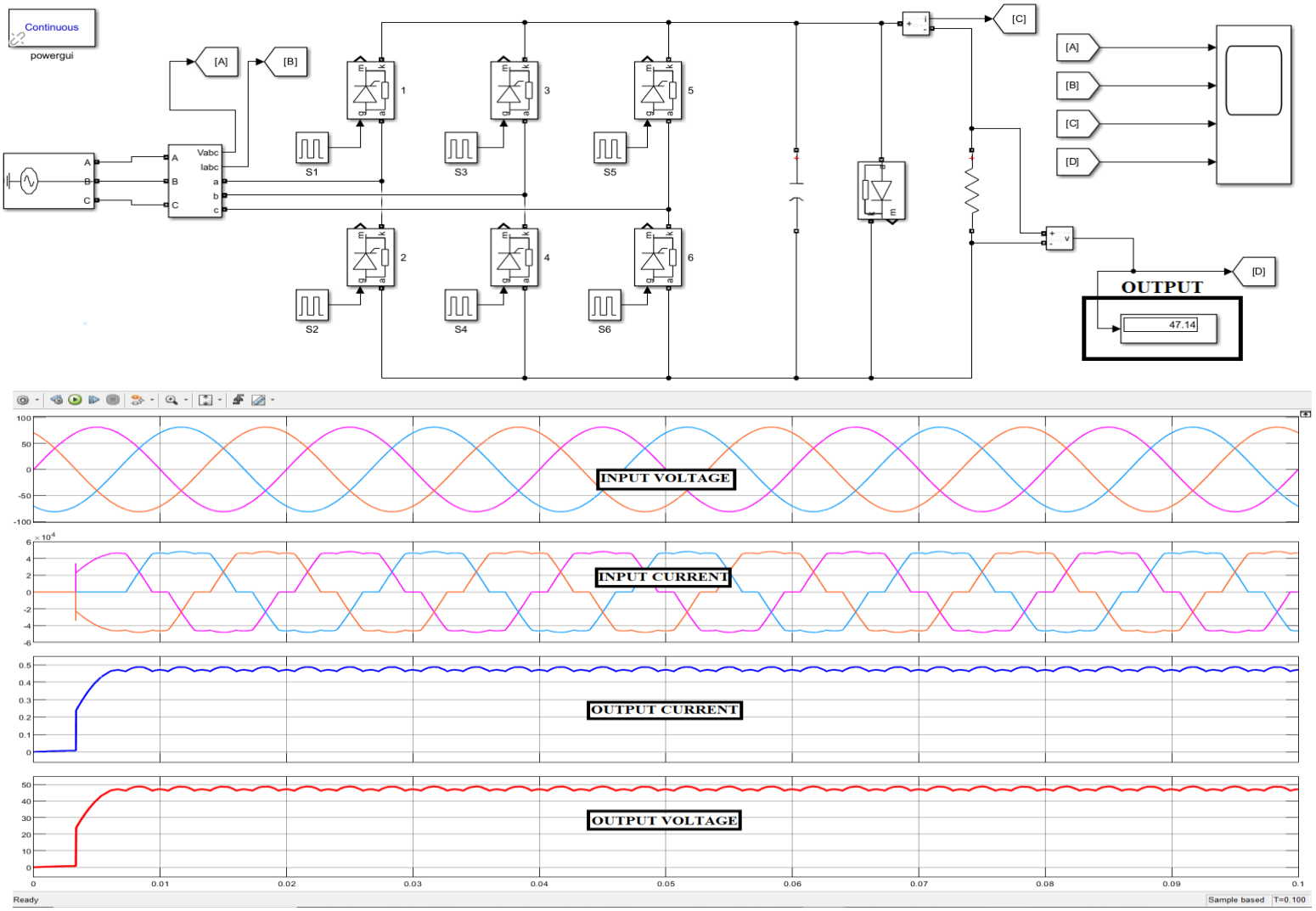
Introduction
This project delves into the analysis of a three-phase controlled rectifier circuit using MATLAB/Simulink. Designed for efficient power conversion, the circuit involves a three-phase source, six thyristors, a six-pulse configuration, filtering capacitor, diode rectification, and a resistive load. Through mathematical modeling and simulations, this study explores the circuit's dynamic behavior under various operating conditions, aiming to elucidate its performance characteristics and efficiency in power electronics applications.

Mathematical Relations and Functions

Instantaneous Voltage (V_phase):
$V_{\text{phase}}(t)=V_m \cdot \sin(\omega t+\phi)$
Instantaneous Current (I_phase):
$I_{\text{phase}}(t)=I_m \cdot \sin(\omega t+\theta)$
Average DC Voltage (V_dc):
$V_{\text{dc}}=\frac{3\sqrt{6}}{\pi} \cdot V_m \cdot \cos(\alpha)$
RMS Current (I_rms):
$I_{\text{rms}}=Im/(\sqrt{2})$
Power Factor (PF):
$\text{PF}=\cos(\alpha)$

Difference / *Case*	***V_{in}*** *(v)*	***Source frequency*** *(Hz)*	***Capacitance*** *(F)*	***Resistance*** *(Ω)*	***V_{out}*** *(v)*
1	**100**	**50**	**50×10^{-6}**	**100**	**47.14**
2	150	60	30×10^{-6}	80	70.71
3	400	40	99×10^{-6}	150	188.6
4	50	15	70×10^{-6}	10	11.78





Methodology

Using MATLAB/Simulink, we simulate a three-phase controlled rectifier circuit with components including a three-phase source, six thyristors, a filtering capacitor, a rectifying diode, and a resistive load. Employing mathematical models, we systematically vary parameters to analyze the circuit's response under diverse conditions. The simulation results provide insights into the circuit's performance characteristics, ensuring a comprehensive understanding of its dynamics and efficiency.

Empirical results and discussion:

Simulation results demonstrate the circuit's efficient performance across diverse conditions, showcasing its suitability for practical applications. Key characteristics, such as average DC voltage and RMS current, emphasize the circuit's optimization potential. The study highlights the robustness of the three-phase controlled rectifier circuit in power electronics.

Conclusions

In conclusion, the study validates the efficiency and robustness of the three-phase controlled rectifier circuit for diverse power electronics applications. The findings underscore its potential for practical implementation and optimization.