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TITLE:

A STUDY ON PID TUNING FOR LIQUID FLOW USING ZIEGLER-NICHOLS AND TYREUS-LUYBEN TECHNIQUES

SUPERVISOR:

PN. NURUL 'UYUN BINTI AHMAD

SCHOOL OF CHEMICAL ENGINEERING
COLLEGE OF ENGINEERING

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AUTHOR'S DECLARATION

" I hereby declare that this report is the resof my own work except for quotations and summaries which have been duly acknowledged."

Name of Student	:	SHARIFAH UMAIRAH BINTI SYED SUPIYAN
Student I.D. No.	:	2022665052
Programme	:	Diploma in Chemical Engineering
College/School	:	College of Engineering/School of Chemical Engineering
Signature of Student	:	
Date	:	12.2.2025

ABSTRACT

This research investigates the effectiveness of different PID tuning methods for liquid flow process control using the Liquid Flow Process Control Training System (Model SE270-1). This study focuses on comparing two established tuning methods, namely Ziegler-Nichols (Z-N) and Tyreus-Luyben (T-L). Despite the widespread use of PID controllers in industrial flow control systems, determining the optimal tuning parameters remains challenging, often resulting in unstable system responses and inefficient process control. This research systematically evaluates both tuning methods through experimental analysis and performance comparison.

The methodology involves conducting open-loop and closed-loop tests on the SE270-1 system to determine critical system parameters. Performance metrics including settlement time, percentage overshoot, and steady-state error were measured and analyzed for both tuning methods. The research focuses primarily on the configuration of PI and PID controllers, as these are most relevant for applications in the industry.

The results show that although the Ziegler-Nichols method provides a faster initial response time, it also exhibits higher overshoot (approximately 18.25%) and more oscillatory behavior. In contrast, the Tyreus-Luyben method shows superior stability with minimal oscillation, even with very long settling times. The optimal PID parameters are determined as P=36.4, I=34.32, and D=1.2 for the Tyreus-Luyben method, which provide the best balance between response time and stability for fluid flow control applications based on the results obtained.

This study contributes to the field by providing empirical evidence for selecting the appropriate tuning method in fluid flow process control, especially for educational and industrial training applications as it is very important. The findings obtained indicate that the Tyreus-Luyben method is more suitable for processes that require stable operation with minimal oscillation, while the Ziegler-Nichols remains valuable for applications where fast response is prioritized over stability.

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