

UNIVERSITI TEKNOLOGI MARA

**EJECTION FRACTION
CALCULATION OF THE HEART
USING DIFFERENT MODELS AND
VOLUME METHODS**

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January 2026

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ACKNOWLEDGEMENT

First and foremost, I offer my deepest praises and gratitude to Allah SWT. It is only by His blessings, strength, and will that I was able to endure the challenges of this journey and succeed in completing this research.

I am extremely grateful to my supervisor, Dr. Mohd Rivaie bin Mohd Ali. Thank you for your patience and for sharing your invaluable knowledge with me. Your constructive feedback and constant encouragement were the guiding lights that helped me navigate through this project.

My sincere thanks also go to Dr Norhaslinda binti Zull Pakkal. Your advice and willingness to help whenever I encountered difficulties played a massive role in my progress and understanding of the subject matter.

To the lecturers and staff at UiTM Kuala Terengganu, thank you for the knowledge and administrative support provided to me throughout my years of study here.

To my beloved family, thank you for being my ultimate source of strength. I would like to express my deepest gratitude to my mother, Asmah Jaafar, whose incredible resilience and unwavering support despite her health challenges have been my greatest inspiration. I am also deeply thankful to my father, Muhammad Razwan Lim, for his immense role in providing the motivational and financial support that allowed me to complete my studies. My sincere appreciation also goes to my brother and my aunt for their constant encouragement and for always believing in my potential. Your combined love and sacrifices provided the motivation I needed to keep going.

I also want to acknowledge Julia Batrisyia, who has been a wonderful partner through this process. To my friends and colleagues, who helped me brainstorm, study, and keep my spirits up. Thank you.

A special note of appreciation to Daniel Obliza for being my pillar of strength during the most challenging moments of this project. I am truly grateful for your presence and for staying by my side through the highs and lows, especially when the journey felt overwhelming.

Finally, to all those who have contributed in various ways to this research, please accept my heartfelt appreciation.

ABSTRACT

Ejection Fraction (EF) is a vital parameter in the analysis of cardiac pumping efficiency using echocardiography, helping physicians monitor the heart and detect heart disorders. However, traditional assessment frequently suffers from an over-reliance on a single method, typically Simpson's 1/3 Rule with fixed subintervals $n = 20$. This approach often produces significantly distorted EF values due to inaccuracies inherent in constant subintervals and the effects of image foreshortening. Consequently, this research focuses on the comparison of distinct numerical techniques for calculating EF from echocardiographic images to identify the most precise mathematical model for clinical use. The study evaluates Simpson's 1/3, Simpson's 3/8, and Trapezoidal Rule, alongside geometric volume modelling using the Bullet and Bi-Plane Long-Axis Ellipse (BPLAE) methods. Manual tracing is conducted on apical two-chamber and four-chamber views across three subintervals $n = 20, 24$, and 48 . The standard $n = 20$ data obtained directly from the echocardiogram served as the benchmark for accuracy and is used to validate the deviation of experimental methods. The results demonstrate that the BPLAE method yields the highest accuracy and consistency relative to the benchmark. Ultimately, this study establishes that employing the BPLAE method offers a superior alternative to relying on fixed-interval measurements for achieving EF estimates that are both reliable and clinically meaningful.