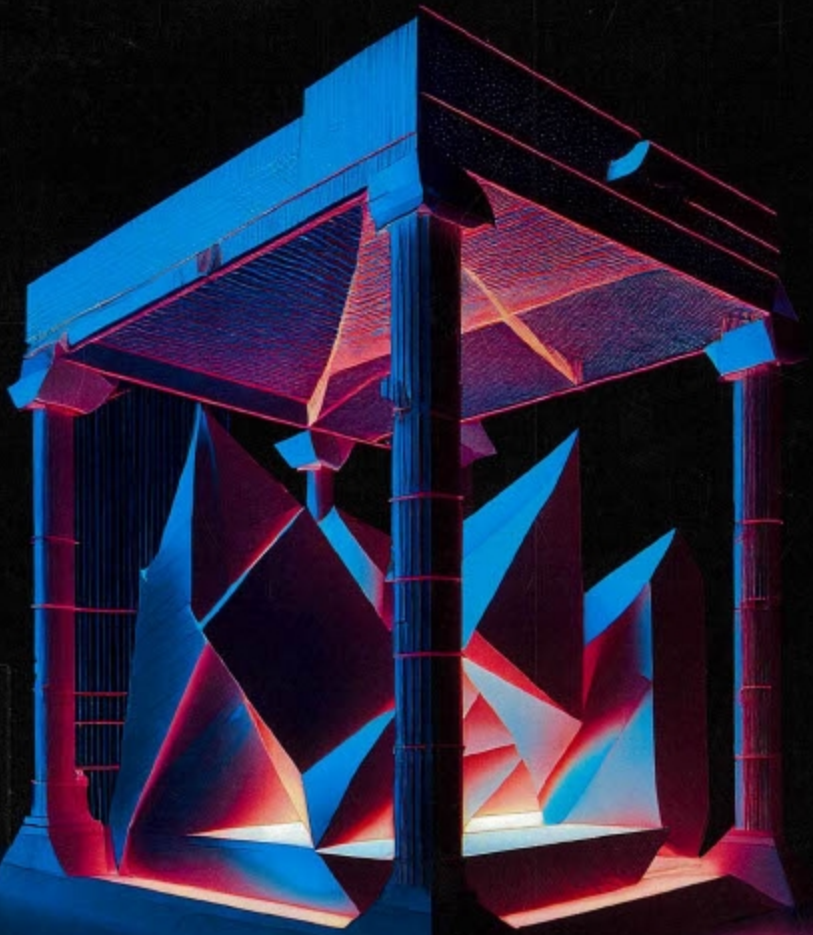
DESIGN AND 3D PRINTING OF ORIGAMI STRUCTURE



SHAJAHAN MAIDIN
JUFRI HANINI HASAN

DESIGN AND 3D PRINTING OF ORIGAMI STRUCTURE

This book introduces folding techniques from origami to evolve from flat material to the additive manufacturing application's deployed state. This book explores the design of various origami structures from different folding techniques, understands their underlying mechanisms, and creates physical models and simulations to demonstrate and compare their feasibility. Mountain and valley folds have been identified among other folding techniques and origami shapes. All these concepts were applied in the design of the origami structure. Seven origami ideas were developed to determine the structural abilities of origami on folding. The model was developed using CAD tools (SolidWorks, Oripa, and Origami Simulator). Three analyses on three folding ideas have demonstrated the outcomes of design deformation using strain analysis. The research revealed that the change in the strain at the fold has a safe value for folding many times. The difference in strain values between the valley and mountain folds on folds with holes (maximum strain is 7.917E -03, maximum strain when folding occurs is 5.9387E -03) is lower than on folds without holes (maximum strain is 5.957E -03, maximum strain when folding occurs is 5.957E -03), proving that folds with holes in the centre point are stronger and safer. Lastly, The FDM 3D Printer was used to test the origami structure's viability on PETG materials. The result demonstrates that an FDM 3D printer can create origami structures with a variety of design origami.

SHAJAHAN MAIDIN is an Associate Professor and has served 19 years in academic and research at the Faculty of Industrial and Manufacturing Technology and Engineering, Universiti Teknikal Malaysia Melaka (UTeM). He received his BEng (Hons) in Manufacturing System Engineering from the University of Portsmouth, United Kingdom. MSc. in Manufacturing System Engineering from the University of Warwick, United Kingdom. Ph.D. in Manufacturing Engineering from Loughborough University, United Kingdom. He is a certified Chartered Engineer (Institution of Mechanical Engineers, United Kingdom) and a Professional Technologist (Malaysia Board of Technologists) as well as a Professional Engineer (Board of Engineers Malaysia). He is a certified professional for Autodesk AutoCAD. His current research and publication interest is mainly in additive manufacturing.

JUFRI HANINI HASAN received his Bachelor of Engineering (Hons) in Manufacturing Engineering, majoring in Manufacturing Design from Universiti Teknikal Malaysia Melaka. On a worldwide scale, he ha aspired to develop origami in FDM. He won the best project award in th automation diploma, was elected as a student leader, and was awarde the maal-hijrah honour in 2012. His area of interest includes additiv manufacturing, simulation, process optimization, and origami features.

UTeM
PENERBIT UTeM *Press*
Website : www.utem.edu.my/penerbit
Books Online : utembooks.utem.edu.my
Email : penerbit@utem.edu.my

ISBN 978-629-7658-24-7
9 786297 658247
03700

ISBN: 978-629-7658-24-7

FIRST PUBLISHED 2025

Member of the Malaysian Scholarly Publishing Council (MAPIM)
Member of Malaysian Book Publishers Association (MABOPA)
Member of Clarivate Analytics

Editor and Proof Reader:
Mohd Rizal Alkahari

Manuscript Editor:
Rahizah Abdul Rahman

Book Cover Designer and Typesetter:
A.S. Jaffar

Published and Printed in Malaysia by:
Penerbit UTeM Press
Universiti Teknikal Malaysia Melaka
Hang Tuah Jaya, 76100 Durian Tunggal, Melaka, Malaysia.
Tel: +606 270 1241 Fax: +606 270 1038

Cataloguing-in-Publication Data

Perpustakaan Negara Malaysia

A catalogue record for this book is available from the National Library of Malaysia

ISBN 978-629-7658-24-7

TABLE OF CONTENTS