

UNIVERSITI TEKNOLOGI MARA

**FORM-FINDING USING
NONLINEAR ANALYSIS METHOD
OF TENSIONED FABRIC
STRUCTURE IN THE FORM OF
HALF-COSTA WITH DIFFERENT
BOUNDARIES**

NURUL AFIQAH BINTI ABD MALEK

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

Name of Student : Nurul Afiqah binti Abd Malek

Student I.D. No. : 2016906289

Programme : Master of Science (Civil Engineering) – EC750

Faculty : Civil Engineering

Thesis Title : Form-Finding using Nonlinear Analysis Method of Tensioned Fabric Structure in the Form of Half-Costa with Different Boundaries



Signature of Student :

Date : June 2020

ABSTRACT

Tensioned fabric structure is an outstandingly lightweight and flexible type of roofing structure which are efficient for vast construction applications. This structure has the ability to adopt interesting forms. Minimal surfaces appears to be the most suitable group of surfaces for tensioned fabric structure application due to its stability. Half-Costa in YZ-plane is chosen among other minimal surfaces on the account of the complexity and uniqueness. This surface emerges from Costa minimal surface that is divided on the YZ-plane. Half-Costa TFS model in YZ-plane poses many curvatures and does not have a mathematically defined boundary. Since this form is chosen as a roofing structure, the problem of boundary condition are addressed. Therefore, the aim of this study includes proposing suitable range of geometry which will focus on top part of half-Costa TFS model and investigation on boundary condition towards the idea of half-Costa TFS model in YZ-plane. In order to ensure proposed models are structurally viable to become a roofing structure, form-finding is carried out based on nonlinear analysis method. This computational form-finding involves series of analysis which started with an initial assumed shape. This shape are then went through stress analysis followed by convergence checking. Initial equilibrium shape are obtained subsequent to convergence. Three heights are introduced for range of geometry and out of these heights, only $H= 2.826$ unit is able to achieved convergence. The form-finding for different boundaries are proceeded with the converged height. There are ten boundaries that are in equal tensioned, presented in this study alongside with the application of cable reinforced for each of the model. Results are presented in graph of total stress deviation versus stress analysis stage and initial equilibrium shape. All in all, there are certain degree of challenges in achieving convergence since initially assumed shape greatly affect the convergence of half-Costa TFS model. Nonetheless, the outcome of this study has put forth half-Costa TFS model in YZ-plane as the next form to be taken into account in TFS application.

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