UNIVERSITI TEKNOLOGI MARA

DEVELOPMENT OF MINIMAL SURFACE ON MONKEY SADDLE, HANDKERCHIEF AND THOMSEN SURFACES IN TENSIONED FABRIC STRUCTURES

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ABSTRACT

Tensioned fabric structures are typically designed in the form of equal tensioned surface. New form of minimal surface are Monkey Saddle, Handkerchief and Thomsen surface are applied in TFS. These shapes are very versatile in producing structures with a broad variety of surface shapes. This study are applied the model of Monkey Saddle, Handkerchief and Thomsen surface because this model are not studied by other researchers in TFS. Besides, No other work on the models as idea of TFS have been found. Computational form-finding using nonlinear analysis method and experimental form-finding using soap film have been carried out in this study. Soap film models are developed to verify the computational form-finding results and investigate the possible form of uniform stress surfaces of Monkey Saddle, Handkerchief surface and Thomsen surface. The objective of this study is to determine initial equilibrium shape and This study are applied cable reinforced in Monkey Saddle, Handkerchief surface and Thomsen surface under a prescribed pre-stress system and boundary condition. Additionally, the variables of Monkey Saddle, Handkerchief surface and Thomsen surface have been studied. Monkey Saddle TFS models with variables $u=v<2.23$, Handkerchief TFS models with variables $u=v<3.13$ and Thomsen TFS models with variables $u=v<2.00$ have been found corresponding to equal tension surface. The result shows the model of Monkey Saddle soap film with variables $u=v<2.23$, Handkerchief soap film with variables $u=v<3.13$ and Thomsen soap film with variables $u=v<2.00$, The surface of computational and experimental form-finding are compare together. Then, geometry surface of computational and experimental models have been found to match very closely. The model of Monkey Saddle, the transformation of variables in Monkey Saddle shows the constants u and v increase, the height between legs and tail also increase. The form-finding of Monkey Saddle cable reinforced has been found to converge. For the model of Handkerchief surface, transformation of variable in Handkerchief surface. When, the constant u and v increase, the area of the surface also increases. Form-finding of Handkerchief cable reinforced have been found to converge. For model of Thomsen surface, The transformation of variables in the Thomsen surface shows that the constants u and v increase, and the turning of Thomsen surface also increased. Form-finding of Reinforced Thomsen cable has been found to converged. The initial equilibrium shape of Monkey Saddle, Handkerchief surface and Thomsen surface will provide alternative shapes for designers to consider for adoption in tensioned fabric structures.

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