

Accepted Manuscript

Non-parametric shape optimization method for designing cable net structures in form finding and stiffness maximization problems

Masatoshi Shimoda , Koichi Yamane , Jin-Xing Shi

PII: S0020-7683(18)30135-5
DOI: [10.1016/j.ijsolstr.2018.03.027](https://doi.org/10.1016/j.ijsolstr.2018.03.027)
Reference: SAS 9952



To appear in: *International Journal of Solids and Structures*

Received date: 25 July 2017
Revised date: 8 March 2018
Accepted date: 27 March 2018

Please cite this article as: Masatoshi Shimoda , Koichi Yamane , Jin-Xing Shi , Non-parametric shape optimization method for designing cable net structures in form finding and stiffness maximization problems, *International Journal of Solids and Structures* (2018), doi: [10.1016/j.ijsolstr.2018.03.027](https://doi.org/10.1016/j.ijsolstr.2018.03.027)

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Non-parametric shape optimization method for designing cable net structures in form finding and stiffness maximization problems

Masatoshi Shimoda^a, Koichi Yamane^b, Jin-Xing Shi^{a,*}

^a *Department of Advanced Science and Technology, Toyota Technological Institute, 2-12-1 Hisakata, Tenpaku-ku, Nagoya, Aichi 468-8511, Japan*

^b *Graduate School of Advanced Science and Technology, Toyota Technological Institute, 2-12-1 Hisakata, Tenpaku-ku, Nagoya, Aichi 468-8511, Japan*

* Corresponding author: shi@toyota-ti.ac.jp (J.X. Shi)

ABSTRACT

Cable net structures, belonging to the tension structures, have been widely utilized in structural engineering. In this study, we develop a non-parametric shape optimization method based on the H^1 gradient method for designing cable net structures in form finding and stiffness maximization problems. We divide the design velocity field of cable net structures into the off-axis and the in-axis components for deriving and applying the shape gradient function in each design problem conveniently. In the form finding problem, we use the total length of cables as the objective functional and minimize it without or with considering the constraint condition of perimeter. In the stiffness maximization problem, the compliance is used as the objective functional and minimized under the constraint condition of perimeter and total length of cables considering large deformation and small strain. Moreover, two-step shape optimization of cable net structures from the form finding problem to the stiffness maximization problem is also implemented. The validity of the developed shape optimization method is confirmed by design examples.

Keywords: Cable net; Compliance; Form finding; Non-parametric; Shape optimization; Stiffness maximization.

Download English Version:

<https://daneshyari.com/en/article/6748251>

Download Persian Version:

<https://daneshyari.com/article/6748251>

[Daneshyari.com](https://daneshyari.com)