Accepted Manuscript

Fiber path optimization based on a family of curves in composite laminate with a center hole

Yingdan Zhu, Jiancai Liu, Dong Liu, Haibing Xu, Chun Yan, Bin Huang, David Hui

PII: S1359-8368(16)31868-6

DOI: 10.1016/j.compositesb.2016.11.051

Reference: JCOMB 4744

To appear in: *Composites Part B*

Received Date: 5 September 2016

Revised Date: 16 November 2016

Accepted Date: 21 November 2016

Please cite this article as: Zhu Y, Liu J, Liu D, Xu H, Yan C, Huang B, Hui D, Fiber path optimization based on a family of curves in composite laminate with a center hole, *Composites Part B* (2016), doi: 10.1016/j.compositesb.2016.11.051.

Fiber path optimization based on a family of curves in composite laminate with a center hole

Yingdan Zhu[1*], Jiancai Liu[2], Dong Liu[1], Haibing Xu[1], Chun Yan[1], Bin Huang[3], David Hui[4*]

[1]Zhejiang Provincial Key Laboratory of Robotics and Intelligent Manufacturing Equipment Technology, Ningbo Institute of Material Technology and Engineering, Chinese Academy of Sciences, Ningbo, China;

[2]Changan Auto Global R&D Centre，Chongqing Changan Automobile Co. Ltd，Chongqing, China;

[3]Ningbo University, Ningbo, China;

[4]Department of Mechanical Engineering, University of New Orleans, USA

ABSTRACT: A family of curves based fiber path optimization approach is developed to optimize the fiber paths in composite laminate with a centered hole, in an attempt to improve the uniaxial tensile load carrying capabilities. In the proposed optimization method, a novel family of curves with two design variables is assumed to approximate the fiber paths in composite laminate. The principal stress trajectories are chosen as the desired fiber paths in order to make full usage of the mechanical properties of continuous fibers. The objective function is constructed by the nonlinear weighted least squares method, taking the first principal stress components as the weights. Using the Trust-Region-Reflective algorithm, the design variables appeared in the family of curves can be optimized. Once the optimal design variables are obtained, consequently, the fiber paths are optimized. With the obtained optimal path results, a comparative study will be given by means of two laminates, the path optimized