

Accepted Manuscript

Stress redistribution as an effect of non-uniform in-plane laminate stresses in laminate composite plates

Yoshiki Fukada

PII: S0263-8223(16)30863-7

DOI: <http://dx.doi.org/10.1016/j.compstruct.2016.09.089>

Reference: COST 7815

To appear in: *Composite Structures*

Received Date: 10 June 2016

Revised Date: 8 September 2016

Accepted Date: 28 September 2016



Please cite this article as: Fukada, Y., Stress redistribution as an effect of non-uniform in-plane laminate stresses in laminate composite plates, *Composite Structures* (2016), doi: <http://dx.doi.org/10.1016/j.compstruct.2016.09.089>

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.

Stress redistribution as an effect of non-uniform in-plane laminate stresses in laminate composite plates

Yoshiki Fukada^{a,1,*}

^a*Toyota Motor Corporation, 1200 Mishuku, Susono-shi, Shizuoka-ken, 410-1193, Japan*

Abstract

This paper describes a phenomenon that significantly affects the stress distribution in notched laminate composite structures. Ply-to-ply interactions under non-uniform laminate stress fields induce interlaminar and in-plane stresses that are not described in classical laminate theory. The theory consists of a power series expansion along the thickness-wise coordinate. The most prominent influence of this effect is a substantial reduction in stress concentrations around notches. This may explain various experimental facts that conflict with classical laminate theory. Although this phenomenon appears to be a derivative of the so-called free-edge effect, it is not based on free-edge boundary conditions. For verification of the theory, this paper also presents finite element analysis cases for 5 mm diameter open hole [90/0]_s cross-ply laminate plates. Reductions in stress concentration around hole edges were up to 10% of the far field stress. Insertion of low elasticity layers between 90 and 0 degree plies, the use of thick plies, or the adoption of ply materials with low transverse shear moduli were identified as effective means of reducing stress concentration around a hole. These findings may enable the application of new design principles to deal with stress concentrations for notched composite structures.

Keywords: A. Layered structure, B. Delamination, C. Laminate theory, C. Plate theory, C. Finite element analysis (FEA)

*Corresponding author

Email address: yoshiki_fukada@mail.toyota.co.jp (Yoshiki Fukada)

¹TEL:+81-55-997-7546, FAX: +81-55-997-7884

Download English Version:

<https://daneshyari.com/en/article/4917932>

Download Persian Version:

<https://daneshyari.com/article/4917932>

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