

**XVIII INTERNATIONAL CONFERENCE**

**CONFERENCE**

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**BOOK OF ABSTRACTS**

**MECHANICS  
OF COMPOSITE MATERIALS**

**JUNE 2 - 6, 2014  
RIGA, LATVIA**



**INSTITUTE OF POLYMER MECHANICS  
UNIVERSITY OF LATVIA**

**EIGHTEENTH INTERNATIONAL CONFERENCE  
MECHANICS OF COMPOSITE MATERIALS**

**Devoted to the 50 Anniversary of the Institute of Polymer Mechanics  
University of Latvia**

**June 2 – 6, 2014  
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**BOOK OF ABSTRACTS**

**Eds. V. Tamužs, K. Cīrule, and V. Kulakovs**

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- Institute of Polymer Mechanics

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- Latvian Academy of Sciences
- Latvian Council of Science
- Latvian National Committee for Mechanics
- University of Latvia
- Riga Technical University
- Journal *Mechanics of Composite Materials*
- Scientific Enterprise *Lakomp*
- Centre Composite (*Latvia*)

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## POST-BUCKLING BEHAVIOR OF A LAYERED COMPOSITE BEAM WITH DELAMINATION

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Delamination of layered composite is one of the most common defects in the composite structural elements of aircraft. This damage may occur both during manufacturing and during operation of the aircraft, and significantly reduces the compressive strength of damaged structural element.

The objectives of this paper are: 1) to develop an accurate 1D nonlinear model of post-buckling deformation of a beam of layered composite with delamination and 2) to build a model of fracture a laminate in post-buckling stage. The analysis of the possible modes of equilibrium of a layered composite plate in the post-buckling with through delamination in the middle plane, or at a fixed distance from it was done. Large deflections and membrane strains of a plate in buckled state, as well as the strain energy described using elliptic integrals.

The Griffith-type energy condition was used to determine the limit equilibrium at the front of the delamination and investigate its stability.

Assessing the strength of buckled layers was carried out by the criteria of the maximum strain in the direction of the compression. The analysis of the destruction of the plate was performed depending on the geometrical dimensionless parameters of a plate and the material strength performance.

The Figure 1 illustrates two possible versions of destruction development: 1) delamination propagation, and 2) sublaminar destruction at ultimate compression-bending strain.

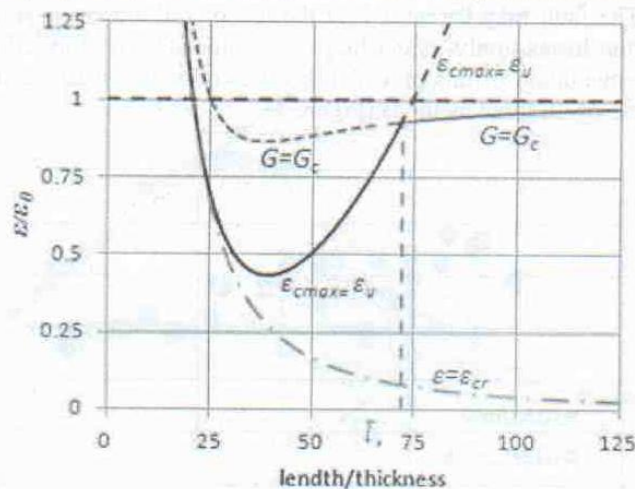


Fig. 1. The diagram of critical state of a composite beam with delamination: two possible versions of destruction development.