GMA 2011

Riunione del Gruppo Materiali dell'AIMETA

Convegno in onore di Cesare Davini

Sala Gusmani, Palazzo Antonini
Udine, 23-26 Febbraio 2011

Con il contributo di:

GEOTECHNOS
NUOVA ISMA

Con il patrocinio di:

ORDINE DEGLI INGEGNERI
PROVINCIA DI UDINE

Programma GMA 2011

Mercoledì, 23 Febbraio 2011 – Palazzo Antonini, Sala Gusmani

12:30 – 14:00	**Registrazione**
14:00 – 14:30	**Saluti ed apertura dei lavori**
14:30 – 15:30	**Prima General Lecture** **U. Galvanetto** *Problems in the mechanics of advanced composite materials and structures*
15:30 – 16:45	**Sessione I** Chairman: C. Davini
15:30 – 15:45	G. Borino, G. V. Marannano, F. Parrinello, A. Pasta, M. Terranova *Cyclic delamination analysis: experimental and cohesive-frictional interface element modelling*
15:45 – 16:00	A. Cavicchi, R. Massabò *Interaction of damage mechanisms in sandwich beams subject to static and dynamic out-of-plane loadings*
16:00 – 16:15	E. Radi, P.M. Mariano *Steady-state propagation of dislocations in planar quasicrystals*
16:15 – 16:30	A. Salvadori, P.A. Wawrzynek, A.R. Ingraffea, A.Carini *On the mixed mode growth of brittle and interface cracks*
16:30 – 16:45	C. Zanini, L. Freddi, R. Paroni, T.Roubicek. *Quasi-static delamination models for Kirchhoff-Love plates*
16:45 – 17:15	**Pausa**
17:15 – 18:45	**Sessione II** Chairman:
17:15 – 17:30	L. Freddi, M.G. Mora, R. Paroni *From 3D non-linear elasticity to 1D elastic models for thin walled beams*
17:30 – 17:45	M. Serpilli, L. Consolini, S. Lenci *Limit models for low, mean and high frequencies of a layered beam*
17:45 – 18:00	R. Paroni, G. Tomassetti *A variational justification of linear elasticity with residual stress*
18:00 – 18:15	L. La Ragione, V. Magnanimo *Anisotropy and coordination number for a granular assembly*
18:15 – 18:30	M. Angelillo, E. Babilio, A. Fortunato *Equilibrium of masonry vaults*

GMA 2011 - Riunione del Gruppo di Meccanica dei Materiali dell'AIMETA
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CYCLIC DELAMINATION ANALYSIS: EXPERIEMENTAL AND COHESIVE-FRICTIONAL INTERFACE FINITE ELEMENT MODELLING

G. Borino*, G.V. Marannano**, F. Parrinello*, A. Pasta** M. Terranova**

**Dipartimento di Ingegneria Civile, Ambientale e Aerospaziale, Università di Palermo, Viale delle Scienze – 90128, Palermo, Italia. Email* borino@unipa.it

***Dipartimento di Ingegneria Industriale, Università di Palermo, Viale delle Scienze – 90128, Palermo, Italia.*

Composite laminates are recognized as high performance structural materials, since they enjoy low weight and high strength features, moreover composites can be optimally employed since they can be designed and tailored following specific load carry requirements.
One of the main concern regarding laminate materials is the possibility of partial internal debonding between laminae, which can happen for several accidental causes and represent a possible starting condition for crack propagation and eventually structural failure.
The problem has been extensively studied, either in terms of experimental tests, or by nonlinear computational approaches. The most considered delamination test is the DCB (double cantilever beam) test and variations of it [1]. The test is based on a laminate beam, with an initial interlaminar defect, subjected to a monotonic increasing bending load.
The present contribution concerns with the analysis of a progressive delamination processes when a composite beam is subjected to cyclic loading. Actually, the typical experimental test for a composite beam in a mixed mode loading condition is extended to cyclic loading and the results in terms of progressive advancement of the crack and cyclic load displacement response are reported.
The actual mechanical problem is also modelled by Finite Element approach, adopting a recent developed interface element [2], which incorporate cohesive and frictional features.
It is shown that under cyclic loading the dissipation mechanisms are of two types, namely the classical crack opening work (fracture energy release) and the frictional energy dissipated. The last contribution in the cyclic contest is rather relevant, since the closing-opening mechanisms induced by the cyclic loading develops frictional energy dissipation even in the case of no crack propagation condition. Finally the good accuracy between tests and computation is commented.

References

[1] G.V. Marannano, A. Pasta, An analysis of interface delamination mechanisms in orthotropic and hybrid fiber-metal composite laminates, *Engineering Fracture Mechanics,* **74,** 612–626, 2007.

[2] F. Parrinello, B. Failla, G. Borino, Cohesive–frictional interface constitutive model, *Int. J. Solids and Structures,* **46**, 2680–2692, 2009