



Challenges for Civil Construction

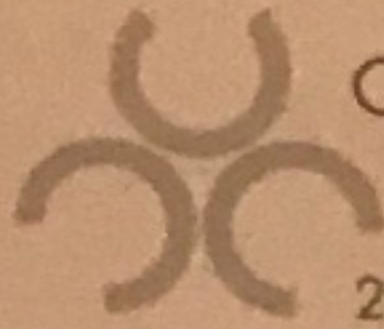
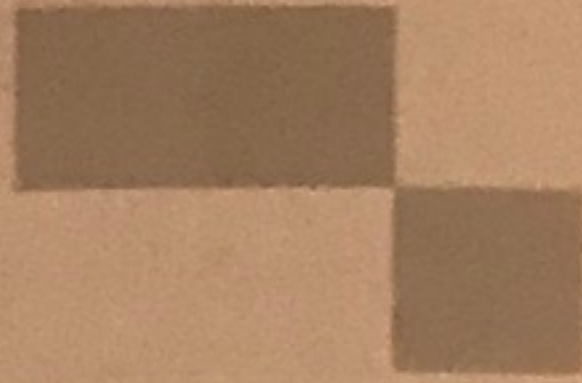
2008

INTERNATIONAL CONFERENCE

"BRIDGE SCIENCE AND APPLICATIONS WITH ENGINEERING
TOWARDS INNOVATIVE SOLUTIONS FOR CONSTRUCTION"

edited by

A. Marques | L. Juvandes | A. Henriques | R. Faria | J. Barros | A. Ferreira



Challenges for Civil
Construction

2008 INTERNATIONAL CONFERENCE

16 - 18th APRIL 2008
Porto - Portugal

CCC2008 Challenges for Civil Construction

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Proceedings of the International Conference

Challenges for Civil Construction
"Bridge Science and Applications with Engineering
Towards Innovative Solutions for Construction"

Safety, Sustainability and Rehabilitation with Innovative Solutions

Porto, Portugal, 16-18 April, 2008

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Print: SerSilito – Empresa Gráfica, S.A.

Cover design: Nelson Pereira I INEGI

ISBN: 978-972-752-100-5

Depósito Legal: 274 736/08

PREFACE

Originally conceived in the Faculty of Engineering of the University of Porto (Portugal) in 2001, the CCC Composites in Construction Conference moved to Rende (Italy) in 2003 and to Lyon (France) in 2005. Thinking about the new challenges that are increasingly being put forward in civil construction, namely to provide innovative and sustainable materials and technical solutions, it was decided to redefine symbol CCC to mean Challenges for Civil Construction, as it appears in the present edition of the CCC2008 International Conference.

The Organizing Committee is convinced that the CCC2008, with the aim of "Bridging Science and Engineering Applications Towards Innovative Solutions for Construction", will provide a forum for dissemination of new design and construction solutions for Civil Engineering Structures, including issues of great actuality such as rehabilitation of built heritage and health monitoring.

It is the central aim of CCC2008 to bring together engineers, researchers and companies concerned with the new challenges in Civil Construction. For this purpose a set of topics such as Advanced Monitoring Systems, New Cement-Based Materials, Rehabilitation and Durability, Innovative Applications, New Construction Techniques and Systems, Guidelines and Codes and Numerical Modelling was selected to fit the new Conference scope, which received 90 papers, reviewed by an International Scientific Committee. Furthermore, four worldwide recognized researchers were invited to present the following keynote lectures:

- Frieder Seible (University of California, USA):
"Safety of the New San Francisco-Oakland Bay Bridge"
- Christian U. Grosse (University of Stuttgart, Germany):
"Monitoring of Structures Using Wireless Sensors and Acoustic Emission Techniques"
- Pedro Pacheco (University of Porto, Portugal):
"Movable Scaffolding Systems Strengthened with Organic Prestressing"
- Michael Edén (Chalmers University of Technology, Sweden):
"Design for Sustainable Building. A Swedish Perspective"

Finally, a special session in CCC2008 was dedicated to PhD students, providing them an opportunity to present underway R&D activities; the best contribution will be awarded with a prize.

The present Proceeding includes printed versions of the extended abstracts and keynote lectures, and the CD-Rom includes electronic versions of the full-length papers, published as prepared by and under the responsibility of the authors.

The Organizing Committee of CCC2008 wishes that this will be the basis of a long series of Conferences on updated topics related with Challenges for Civil Construction.

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Influence of the properties of externally bonded CFRP on the shear behavior of concrete/composite adhesive joints	84
<i>E. Ferrier, M. Quiertant, K. Benzarti, J-L Clément and P. Hamelin</i>	
A numerical method for predicting intermediate crack debonding of reinforced concrete beams strengthened with FRP plates	86
<i>Luciano Ombres</i>	
Simplified designing model of RC beam strengthened with externally bonded FRP reinforcement.....	88
<i>Marcin Gorski, Rafal Krzywon</i>	
Parametric study of the influence of heat curing methods in residual stresses of a precast concrete bridge beam.....	90
<i>Denise Ferreira, Miguel Azenha and Rui Faria</i>	
Characterization of stress wave propagation in impact-echo method using FEM models of repair systems	92
<i>Lesław Kwaśniewski and Andrzej Garbacz</i>	
Reliability-based calibration of partial safety factor for FRP reinforced concrete.....	94
<i>Raffaello Fico, Andrea Prota, Iunio Iervolino and Gaetano Manfredi</i>	
Stress-strain model for partial CFRP confined concrete	96
<i>Débora R.S.M. Ferreira and Joaquim A. O. Barros</i>	
Application of plasticity theory to existing concrete structures for assessment and strengthening.....	98
<i>Tim J. Ibell, Antony P. Darby and Steve R. Denton</i>	
Coupled thermomechanical model for concrete exposed to fire	100
<i>Jiri Surovec, Petr Kabele and Jan Cervenka</i>	
Assessment of a design procedure to avoid peeling failure in an FRP-strengthened beam	102
<i>Eva Oller, Diego Cobo and Antonio R. Marí</i>	
Retrofit of RC bridge columns under combined axial, shear, flexure, and torsion using CFRP composites	104
<i>Abdeldjelil (DJ) Belarbi, Pedro F. Silva and Sang-Wook Bae</i>	
Properties of FRP-confined concrete columns under axial compressive loading	106
<i>V. Tamužs, R. Tepfers, E. Zile and V. Valdmānis</i>	
How reliable are the available models for predicting the FRP contribution for the shear resistance of RC beams?	108
<i>Gabriel Sas, Björn Täljsten, Joaquim Barros, João Lima, Fedja Arifovic and Anders Carolin</i>	
Linear elastic fracture mechanics approach to edge debonding in plated beams	110
<i>A. Carpinteri, L. De Lorenzis, M. Paggi and G. Zavarise</i>	

5. REHABILITATION AND DURABILITY

Behaviour of RC beams shear strengthening with NSM CFRP laminates	144
<i>Salvador J.E. Dias and Joaquim A.O. Barros</i>	
Hybrid CFRP-based strengthening technique to increase the flexural resistance and concrete confinement of RC columns submitted to axial and cyclic lateral loading.....	146
<i>Joaquim A.O. Barros, Monia Perrone and Alessandra Aprile</i>	
Experimental investigation of flexurally strengthened RC columns with near surface mounted FRP or stainless steel reinforcement	148
<i>Dionysios A. Bournas and Thanasis C. Triantafillou</i>	
Artificial weathering of geosynthetics	150
<i>José R. Carneiro, Paulo J. Almeida and Maria L. Lopes</i>	
Durability of geotextiles exposed to chemical agents	152
<i>José R. Carneiro, Paulo J. Almeida and Maria L. Lopes</i>	
A model to simulate the cyclic axial compressive behaviour of RC columns confined with CFRP sheets	154
<i>Rajendra K. Varma, Joaquim A.O. Barros, José Sena-Cruz and Débora M. Ferreira</i>	
Influence of external bonded CFRP on the behavior of strengthened RC slabs	156
<i>L. Michel, E. Ferrier and P. Hamelin</i>	
Strengthening of flat slabs with transverse reinforcement	158
<i>Inácio Duarte, António M. P. Ramos and Válder J. G. Lúcio</i>	
Rehabilitation of brick masonry	160
<i>M. F. Paulo Pereira, José B. Aguiar, Paulo B. Lourenço and Aires Camões</i>	
Reinforced concrete columns jacketed with FRP composites and subjected to cyclic horizontal loads	162
<i>Carlos Chastre and Manuel A. G. Silva</i>	
Bond behaviour of externally bonded FRP to concrete in the case of 3-point-bending tests	164
<i>Lander Vasseur, Stijn Matthys and Luc Taerwe</i>	
A test method for the evaluation of the effect of loading on the overall durability of different types of GRCs	166
<i>P. Van Itterbeeck, H. Cuypers, P. Purnell and J. Wastiels</i>	
Performance of RC square hollow columns wrapped with CFRP under shear-type load	168
<i>Gian Piero Lignola, Andrea Prota, Gaetano Manfredi and Edoardo Cosenza</i>	
FRP retrofit of walls constructed with historical bricks	170
<i>Alper Ilki, Medine Ispir, Fundagul As, Cem Demir and Nahit Kumbasar</i>	
Temperature and humidity effects on concrete specimens reinforced with externally bonded CFRP systems - pull off tests	172
<i>M. Kliem, L. Juvandes, J. Magalhães, F. Cardoso and P. Costeira</i>	

A MODEL TO SIMULATE THE CYCLIC AXIAL COMPRESSIVE BEHAVIOUR OF RC COLUMNS CONFINED WITH CFRP SHEETS

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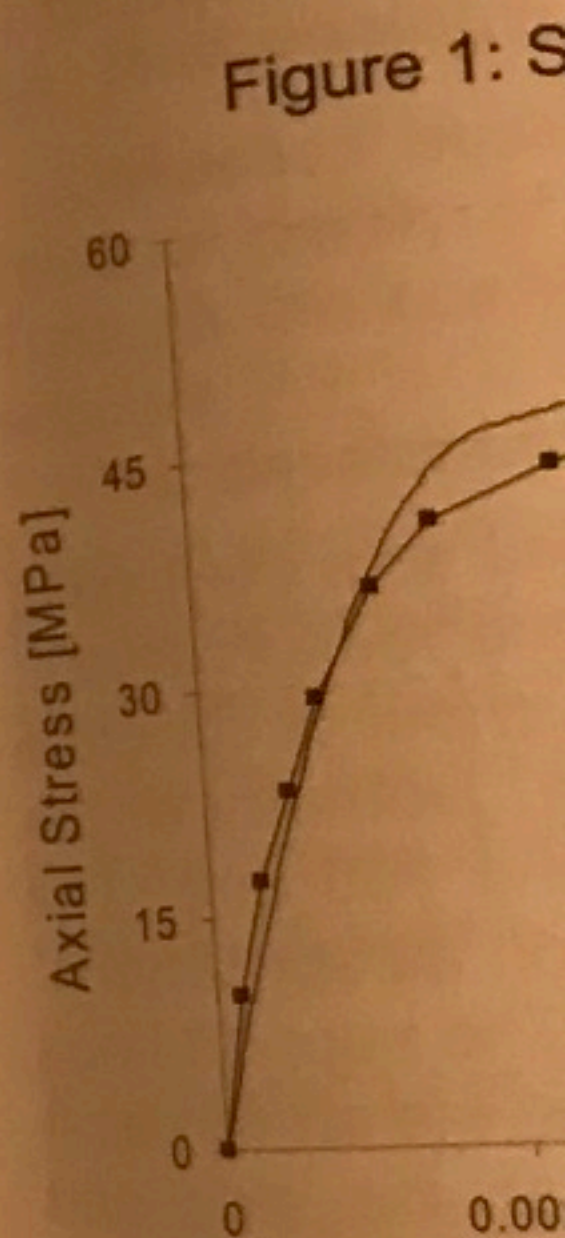
Keywords: Reinforced concrete columns, CFRP, concrete confinement, cyclic behaviour, fibrous model.

ABSTRACT

Concrete confinement strategy has been used, mainly, to increase the energy absorption capacity and the axial load carrying capacity of Reinforced Concrete (RC) columns pertaining to buildings in zones of high seismic risk. In the last years the use of wet lay-up Carbon Fiber Reinforced Polymer (CFRP) sheets to confine RC columns has increased continuously, as consequence of the high mechanical properties of this composite material, its high performance in terms of durability, its easy application and reduced impact in terms of changing the geometry of the strengthened structural elements.

Several analytical models for the simulation of the compressive axial stress-strain constitutive law of FRP-based confined RC columns have been proposed and their performance was appraised [1-3]. However, according to the knowledge of the authors of the present work, a model for predicting the cyclic axial compressive behavior of RC columns confined with CFRP is still in development phase [4]. Based on the results obtained in an experimental program, where RC column elements confined with continuous and discrete CFRP arrangements (CFRP strips in between existent steel hoops) were submitted to cyclic direct compressive axial loading, a new constitutive model was developed and implemented into FEMIX computer program. The proposed model also considers experimental results derived from other researchers. A fibrous model approach was adopted, assuming that RC columns can be discretized by 3D bar finite elements, according to the 3D Timoshenko beam theory. For modeling the behavior of steel bars, a cyclic stress-strain model was also implemented into FEMIX.

The proposed model is composed of two parts, monotonic and hysteretic branches. The monotonic envelope curve is based on Lam and Teng model [2]. The cyclic constitutive laws are derived from by calibrating the parameters of cyclic laws proposed by Chang and Mander [6]. Figure 1 represents, schematically, the envelope and the hysteretic cyclic rules of the developed model, and Figure 2 illustrates its performance on predicting the tested RC column elements. The present work describes the developed model and appraises its performance.



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Part I-Ev

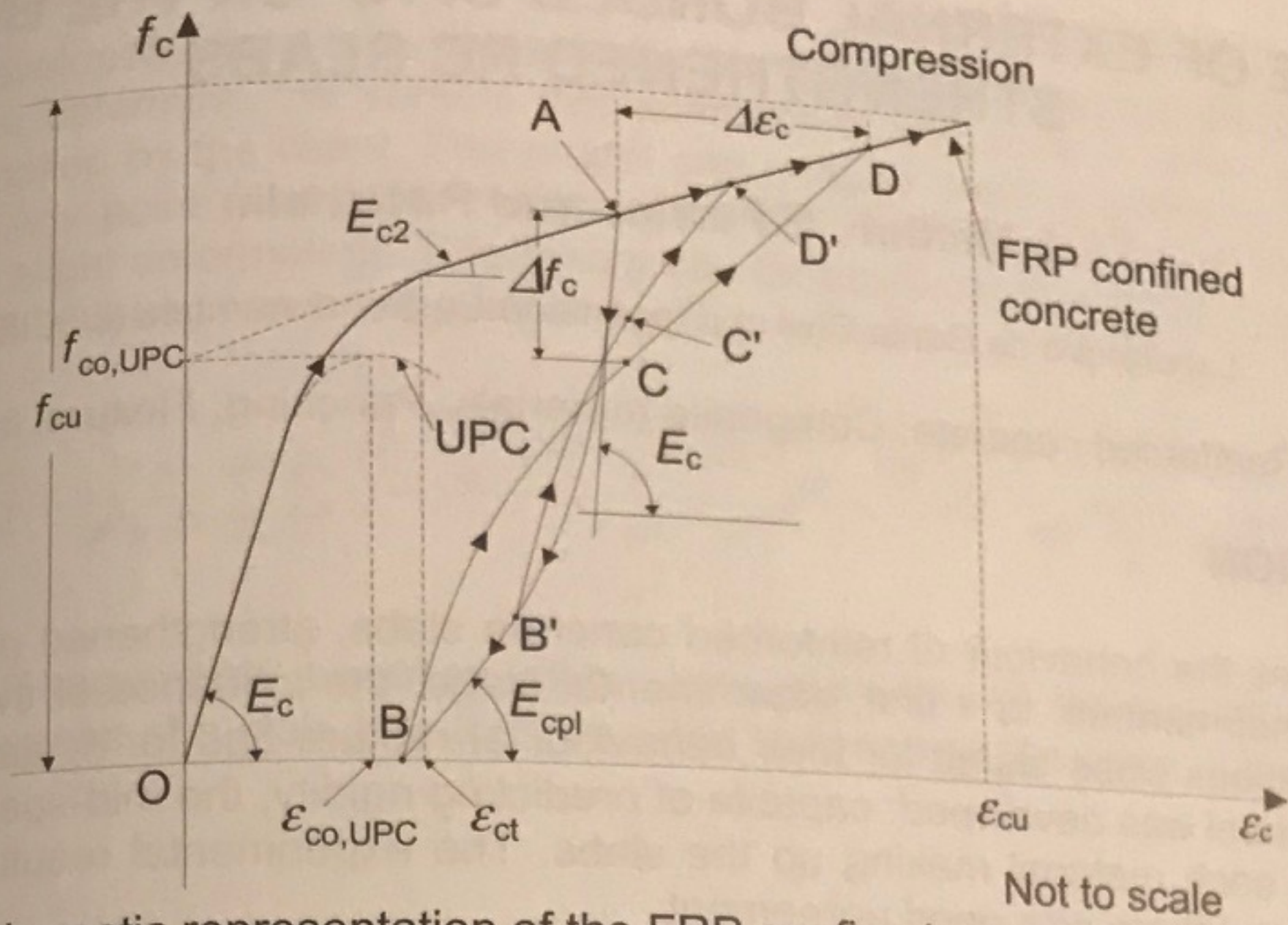


Figure 1: Schematic representation of the FRP-confined concrete constitutive model.

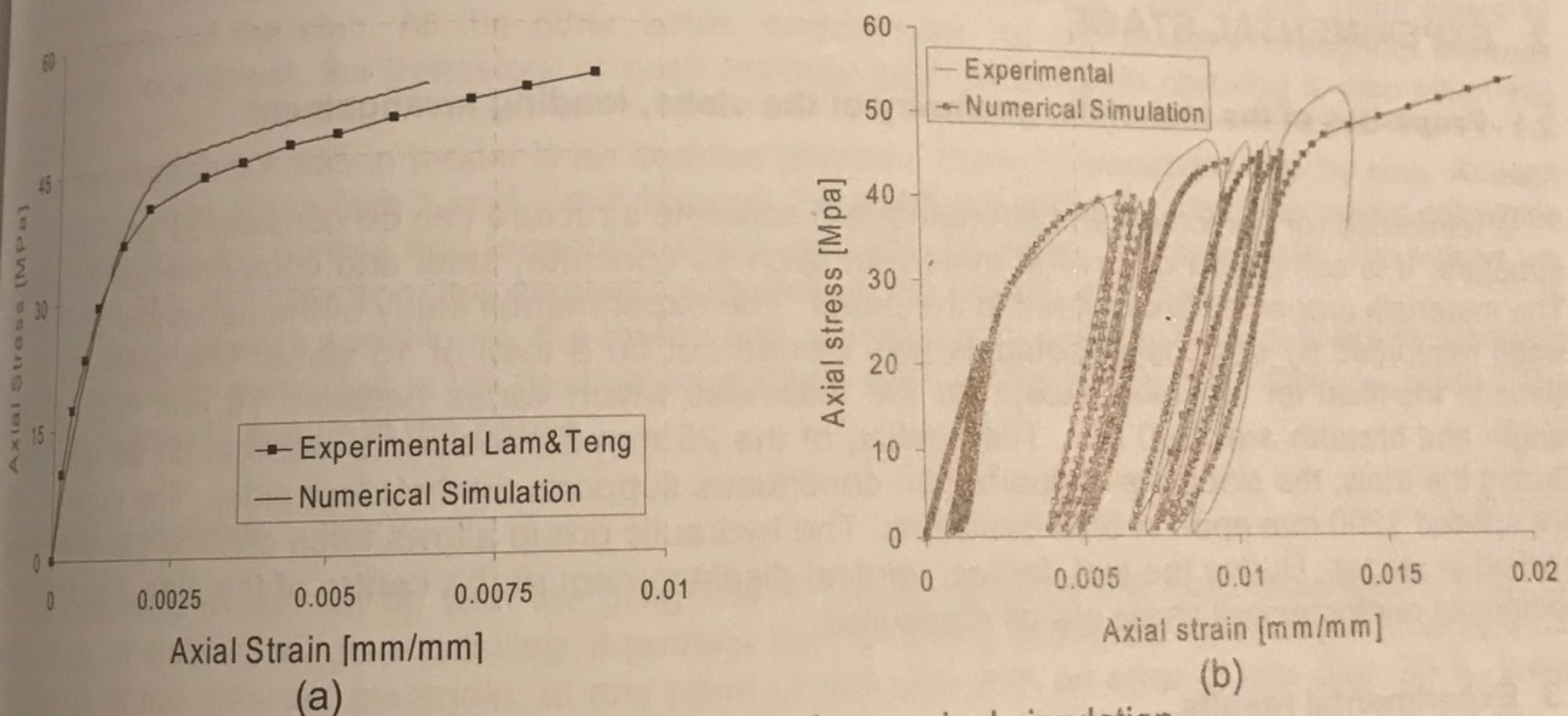


Figure 2: Experimental and numerical simulation.

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