CURRICULUM VITAE DELL'ATTIVITA' SCIENTIFICA E DIDATTICA REDATTO AI SENSI DEGLI ARTT. 46 E 47 DEL D.P.R. 28.12.2000, N. 445 (DICHIARAZIONI SOSTITUTIVE DI CERTIFICAZIONI E DELL'ATTO DI NOTORIETA')

Personal information

NAME/SURNAME	Rosaria Del Toro
E-MAIL	
NATIONALITY	
DATE OF BIRTH	

Professional experience

APRIL 2019 – JULY 2019	software developer, researcher on new materials, involved in communications and events at the spin-off *TREE- TOWER s.r.l.*, Lucca (Italy).

Education

NOVEMBER 2015 – FEBRUARY 2019	Ph. D in *Computer Science and Systems Engineering* at IMT School for Advanced Studies, Lucca. Research unit: MUSAM-multi scale analysis of materials. Dissertation: *Dynamic homogenization of composite viscoelastic materials.* Grade: excellent. Advisor: Prof. Marco Paggi (IMT Lucca). Co-advisor: Dr. Andrea Bacigalupo (IMT Lucca).

ABSTRACT OF *DYNAMIC HOMOGENIZATION OF COMPOSITE VISCOELASTIC MATERIALS*

A non-local dynamic homogenization technique for the analysis of a viscoelastic heterogeneous material which displays a periodic microstructure is herein proposed. The asymptotic expansion of the micro-displacement field in the trans- formed Laplace domain allows obtaining, from the expression of the micro-scale field equations, a set of recursive differential problems defined over the periodic unit cell. Consequently, the cell problems are derived in terms of perturbation functions depending on the geometrical and physical- mechanical properties of the material and its microstructural heterogeneities. A down-scaling relation is formulated in a consistent form, which correlates the microscopic to the macroscopic transformed displacement field and its gradients through the perturbation functions. Average field equations of infinite order are determined by substituting the down-scale relation into the micro-field equation. Based on a variational approach, the macroscopic field equations of a non-local continuum is delivered and the local and non-local overall constitutive and inertial tensors of the homogenized continuum are determined. The problem of wave propagation in case of a bi-phase layered material with orthotropic phases and axis of orthotropy parallel to the direction of layers is investigated as an example. In such a case, the local and non- local over- all constitutive and inertial tensors are determined analytically and the dispersion curves obtained from the non-local homogenized model are analysed.

NOVEMBER 2018 – JULY 2019	Achievement of 24 CFU in anthropology, psychology, pedagogy and methodologies. (Università di Pisa).
NOVEMBER 2012 – APRIL 2015	MA in *Matematics* (110/110 lode) – Università di Siena Thesis: *Fixed point theorems and fractional differential equations (MAT/05).*

Advisor: Prof. Raffaele Chiappinelli (Università di Siena).

ABSTRACT OF *FIXED POINT THEOREMS AND FRACTIONAL DIFFERENTIAL EQUATIONS*

Fractional differential equations have been receiving more and more attention because of their various applications in several fields of applied sciences. In the thesis some elements of fractional differential equations theory are displayed, specifically paying attention to the definition of the Caputo fractional derivative. Moreover, some of the most important fixed point theorems are stated such as the Shauder's theorem and the Krasnoselskii's theorem and, finally, they are used to determine the existence of the solution of some fractional differential equations involving the Caputo derivative.

SEPTEMBER 2009 – DECEMBER 2012

BA in *Matematics* (103/110) – Seconda Università degli Studi di Napoli.
Thesis: *Mechanics of cell membranes (MAT/07)*.
Advisor: Prof. Alfonsina Tartaglione (SUN).

ABSTRACT OF THE THESIS *MECHANICS OF CELL MEMBRANES*

Phospholipid bilayers are object of interest because they properly describe the behaviour of the biological cells which can be employed as adaptative materials for nano-scale applications. First of all, the biological model for the cell membranes is illustrated, then the elastic strains and stresses of the lipid bilayers are described according to the Helfrich model and finally the equilibrium configurations of a simply supported beam made of a biological membrane-like material are calculated.

SEPTEMBER 2004 – JULY 2009

Italian secondary school diploma: Scientific Certificate.

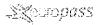## Conferences and academic activities

- I presented the talk entitled *Sylow's theorems* - Università di Siena (June 2014).
- I presented the talk entitled *Producer and Consumer, reader and writer and Peterson's algorithm with OpenMP*- IMT Lucca (April 2016).
- I presented the talk entitled *Inverse Markov chains* - IMT Lucca (May 2016).
- I took part in the summer school *Multiscale bioengineering: from molecules to organs* – Università di Perugia (6th-10th June 2016).
- I presented the talk entitled *Mechanics of cell membranes* - Università di Perugia (June 2016).
- I attended the *XXI convegno italiano di meccanica computazionale e VIII riunione del gruppo materiali* - IMT Lucca (27th-29th June 2016).
- I carried out a traineeship activity at the *Zoological Institute of the University of Kiel* (Germany) under the supervision of Prof. Stanislav N. Gorb (September 2016- November 2016).
- I presented the talk entitled *Gecko tape and its applications* - IMT Lucca (December 2016).
- I presented the poster entitled *La ricerca sui metamateriali gerarchici a IMT* during the event *Bright*- IMT Lucca (28th-29th September 2018).
- I took part as speaker at the GMA-GIMC conference with the talk entitled *A variational-asymptotic homogenization model for the characterization of viscoelastic materials with periodic miscrostructure* - Università di Ferrara (13th-14th September 2018).
- I presented the talk entitled *Characterization of wave propagation in periodic composite viscoelastic materials via asymptotic-variational homogenization.* – Università di Siena (March 2019).

Workshops and seminars

During the Ph.D programs I attended the following seminars and workshops:

- o Workshop: ERC Grants for the Excellence of European Research – IMT Lucca (November 2015)
- o Multiscale asymptotic homogenization analysis of thermo-diffusive composite materials - IMT Lucca (November 2015)
- o Valutazione della ricerca e del dottorato. L'esercizio di valutazione. Quale futuro per Università e Ricerca- IMT Lucca (February 2016)
- o Analytical solutions for modelling delamination of composite laminates: from elastic interface models to discontinuous cohesive laws - IMT Lucca (February 2016)
- o Structures that disapprove linearity: membranes, masonry structures, beams in contact with rough surfaces - IMT Lucca (February 2016)
- o Limit and Nonlinear Elastic Analysis of Masonry Structures: an overview - IMT Lucca (February 2016)
- o Computational methods for interface mechanical problems – Università di Pisa (April 2016)
- o Non-local dynamic homogenization of periodic materials and metamaterials: overall mechanical properties, band structure and acoustic behaviour - Università di Pisa (April 2016)
- o Inclusion invisibility, stress annihilation and stress reduction in antiplane elasticity - IMT Lucca (May 2016)
- o Seminar on metallic and ceramic materials with applications to paper industry- IMT Lucca (May 2016)
- o Innovative entrepreneurship in Universities: from the Ideas to Business Plan - IMT Lucca (June 2016)
- o Phase field modelling of fracture: recent developments and application- IMT Lucca (July 2016)
- o The contact mechanics of elastic and viscoelastic thin layers - IMT Lucca (April 2017)
- o Folding and faulting of continua: statics and dynamics- IMT Lucca (May 2017)
- o Multiscale Computational Modeling of Functional Biological Materials: from Characterization to Design and Synthesis – Università di Pisa (June 2017)
- o Model-free design of linear parameter-varying controllers: a direct data-driven approach - IMT Lucca (June 2017)
- o Object-Oriented Convex Optimization with CVXPY - IMT Lucca (June 2017)
- o Finite Fracture Mechanics: linking strength of materials and fracture mechanics to study crack initiation - IMT Lucca (July 2017)
- o Classical Molecular Dynamics as a Tool for Tribology and Beyond- IMT Lucca (September 2017)
- o Ocean Grazer: a novel ocean energy extraction and storage device- IMT Lucca (September 2017)
- o Workshop: Diritto d'autore, normative di riferimento e casi pratici - IMT Lucca (May 2017)
- o Workshop: Funding opportunities for young researchers mobility- IMT Lucca (February 2017)
- o Contact and interface modeling in nonlinear solid mechanics using mortar finite element methods- IMT Lucca (October 2017)
- o New contact algorithms for nonlinear beam finite elements and their applications to stent graft modelling- IMT Lucca (October 2017)
- o Pitfalls and best practices in parametric identification- IMT Lucca (November 2017)
- o Maximum-likelihood for regression and classification: an overview - IMT Lucca (November 2017)
- o Scalable van der Waals heterostacks for optoelectronics - IMT Lucca (January 2018)
- o Modelling and simulation of tribology processes - IMT Lucca (February 2018)
- o The dynamics of a shear band - IMT Lucca (February 2018)
- o Novel computational models for failure analysis shells. Smeared-based crack and delamination model - IMT Lucca (February 2018)
- o Numerical and experimental proof of the destabilization paradox by using a new flutter machine - IMT Lucca (June 2018)
- o Cracking me softly-the mechanics of hyperelastic Kirigami structures - IMT Lucca (July 2018)
- o Mathematical models, numerical formulations and high performance computing applications of a mesh-less computational fluid dynamics code for free-surface flows, fluid-structure interactions and granular flows - IMT Lucca (July 2018)
- o Auxetics and shape morphing mechanical metamaterials - IMT Lucca (February 2019)
- o Micromorphic vs. strain and stress gradient continuum theories - IMT Lucca (February 2019)

Professional courses

During the Ph.D program, I attended the following courses: applications of stochastic processes; numerical methods for the solution of partial differential equations; convex optimization; identification analysis and control of dynamical systems; networks; micromechanics; computational contact and fracture mechanics; advanced topics of computational mechanics; continuum mechanics (Università di Pisa); principles of concurrent and distributed programming; scientific writing and advanced numerical analysis.
The Ph.D program has been issued in English.

Computer skills

ECDL (Jan 2008); advanced knowledge of MATLAB; MAPLE; FORTRAN.

Languages

Italian (native); English (advanced user B2-Jan 2014); French (advanced user DELF B2-Jan 2009).

Scientific publications

R. Del Toro, A. Bacigalupo, M. Paggi, Characterization of wave propagation in periodic viscoelastic materials via asymptotic variational homogenization, *International Journal of Solids and Structures* (accepted on 7th March 2019). (https://doi.org/10.1016/j.ijsolstr.2019.03.007)

Publications in abstracts of national conferences

R. Del Toro, A. Bacigalupo, M. Paggi, A variational-asymptotic homogenization model for the characterization of viscoelastic materials with periodic microstructure, *Proc. GIMC-GMA*, Ferrara, Italia, 13-14 September 2018.

Ph.D Thesis

R. Del Toro, *Dynamics homogenization of composite viscoelastic materials*, Ph.D Thesis, February 2019, IMT Lucca (Advisor Prof. Marco Paggi, Co-Advisor Dott. Andrea Bacigalupo).

Scholarships and awards

I won a scholarships issued by INPS (Borse di dottorato di ricerca a.a. 2015-2016).

19/3/2019