

Gérard-Philippe Zéhil, Eng., Ph.D.

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CONTACT INFORMATION

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PROFESSIONAL EXPERIENCE

Notre Dame University (NDU), Zouk Mosbeh, Lebanon *Sep. 2014 – present*
Department of Civil and Environmental Engineering
Assistant Professor

Duke University, Durham, NC, USA *summer 2014*
Department of Mechanical Engineering and Materials Science
Postdoctoral Research Fellow – M.I.T.'s Soft Active Materials Laboratory

Duke University, Durham, NC, USA *spring 2014*
Department of Civil and Environmental Engineering
Visiting Assistant Professor

Duke University, Durham, NC, USA *2010 – 2013*
Department of Civil and Environmental Engineering
Research Assistant – Structural Dynamics Laboratory

ARTELIA Engineering, Paris, France *2006 – 2010*
Divison of Transport and Infrastructure, Subdivision of Bridges
Bridge Engineering Project Manager

THALES Engineering and Consulting, Paris, France *2005 – 2006*
Divison of Transport and Infrastructure, Subdivision of Bridges
Principal Bridge Design Engineer

SECOA Engineering, Paris, France *2003 – 2005*
Bridge Design Engineer

EDUCATION

Duke University, Durham, NC, USA *Dec. 2013*
Department of Civil and Environmental Engineering
Ph.D. in Materials, Structures and Geosystems (GPA 4.0)
Dissertation title: "Modeling of Nonlinear Viscoelastic Solids with Damage Induced Anisotropy, Dissipative Rolling Contact Mechanics, and Synergistic Structural Composites."

Centre des Hautes Études de la Construction, Paris, France *June 2003*
Department of Reinforced and Prestressed Concrete
Post-Graduate Degree in Structural Engineering (GPA 4.0).

Université Saint-Joseph, Mar-Roukoz, Lebanon *June 2002*
Faculty of Engineering - École Supérieure d'Ingénieurs de Beyrouth
French course of study equivalent to:
M.S. in Civil Engineering - Infrastructure and Transport (GPA 4.0).

Université Saint-Joseph, Mar-Roukoz, Lebanon *June 2000*
Faculty of Engineering - École Supérieure d'Ingénieurs de Beyrouth
French course of study equivalent to:
B.S. in Civil and Environmental Engineering (GPA 4.0).

PROFESSIONAL
TRAINING AND
INTERNSHIPS

ARTELIA Engineering , Paris, France <i>Training</i> "Design, planning and execution of road earthworks."	<i>Jan. 27–29, 2009</i>
ARTELIA Engineering , Paris, France <i>Training</i> "Water act: classified facilities with respect to environmental protection."	<i>May 23, 2008</i>
CREDEF (research, study, diagnostic and training center) , Paris, France <i>Training</i> "Project management in the context of public procurement."	<i>June 11–13, 2007</i>
École Nationale des Ponts et Chaussées , Paris, France, <i>Training</i> "Eurocodes (European building codes) #3 and 4: design of metallic and composite structures; Application to bridges."	<i>Dec. 11–13, 2006</i>
École Nationale des Ponts et Chaussées , Paris, France, <i>Training</i> "Eurocodes (European building codes) #2: design of reinforced and prestressed concrete structures; Application to bridges."	<i>Oct. 2–4, 2006</i>
École Nationale des Ponts et Chaussées , Paris, France, <i>Training</i> "Eurocodes (European building codes) #2: design of reinforced and prestressed concrete structures; Application to bridges."	<i>Sept. 28–30, 2004</i>
Dar Al-Handasah Consultants , Beyrouth, Lebanon, <i>Internship</i> Structural design work on the Dubai Airport project.	<i>Summer 2001</i>
École Supérieure d'Ingénieurs de Beyrouth , Mar Roukoz, Lebanon, <i>Training</i> On-site training on the operation of advanced topographic equipments.	<i>Summer 1999</i>

TEACHING
EXPERIENCE

Mechanics of Solids (Statics and Mechanics of Materials) <i>Duke University, Durham, NC, USA</i> Instructor.	<i>Spring 2014</i>
Uncertainty, Design, and Optimization <i>Duke University, Durham, NC, USA</i> Graduate Teaching Assistant: conducted weekly recitation classes and office hours; supervised student's projects; graded homework assignments.	<i>Spring 2012</i>
Mechanics of Solids <i>Duke University, Durham, NC, USA</i> Graduate Teaching Assistant: conducted weekly recitation classes and office hours; supervised lab experiments; graded homework assignments and lab reports.	<i>Fall 2012</i>
Advanced Theory and Design of Reinforced and Prestressed Concrete Structures <i>ARTELIA, THALES, Paris, France</i> Conducted graduate level lectures and practiced individual coaching of recent graduates in civil and structural engineering working on the design of reinforced concrete structures.	<i>2005-2010</i>

Bridge Design

2005-2010

ARTELIA, THALES, Paris, France

Conducted graduate level lectures and practiced individual coaching of recent graduates in civil and structural engineering working on the design of concrete bridges, steel bridges and composite bridges.

RESEARCH
EXPERIENCE**Duke University, Durham, NC, USA**

2010 - 2013

Research Assistantship

My research activity focuses on developing and applying new viscoelastic materials, and material models, to engineering structures. Topics addressed in my doctoral research include:

- the unified constitutive modeling of rubber-like materials by means of a new, three dimensional, behavioral characterization in finite strain, valid in a broad range of loading conditions, such as cyclic loading, monotonic loading (including at high strain rates), and damage,
- the constitutive modeling of the Mullins effect induced anisotropy in elastomers,
- the three-dimensional dynamic modeling of incompressible, compressible isotropic, transversely isotropic and fully orthotropic viscoelastic layers of arbitrary thickness, and of plane and spherical shape, by means of new boundary element formulations,
- the solving of steady-state frictional rolling and sliding contact problems, in two and three dimensions, using novel moving-contact algorithms,
- the application of the above-mentioned modeling techniques and solving strategies to the rolling resistance of rigid cylinders and spheres on viscoelastic layers, and to the rolling resistance of rigid spheres with viscoelastic coatings,
- the elaboration of simplified and highly cost-efficient computational approaches to viscoelastic rolling resistance,
- the design of a new experimental setup to explore the influence of material nonlinearities on rolling resistance,
- the study of composite structural members involving mechanical synergies between material components resulting in improved structural behaviors and mechanical performances.

ARTELIA, THALES, Paris, France

2005 - 2010

Project-Embedded Research Activity

Professional engineering projects included research activities such as developing new materials, designing experiments, and fitting and validating new models. Several research proposals were submitted and resulted in official research funding in the form of tax reductions. Examples of project-embedded research tasks include:

- developing a new fire protection system for extradossed prestressing tendons meeting severe specification requirements,
- developing a new formulation of polypropylene fibered concrete meeting specific requirements in terms of fire resistance and resistance to blasting.

IRISA - INRIA, research unit of Rennes, Rennes, France,

Summer 2000

Research Internship

Implemented a new object animation module in C++, based on the laws of continuum mechanics and strength of materials, and integrated this module into an existing software platform under Unix.

HONORS AND
AWARDS

Received the Senol Utku Award for the best pre-Ph.D. peer-reviewed journal paper from Duke University, 2014.

Received a travel award to attend the 12th U.S. National Congress on Computational Mechanics held in Raleigh, NC, July 22-25, 2013.

Received the highest ranking graduate award from *Centre des Hautes Etudes de la Construction* and from *Centre d'Information sur le Ciment et ses Applications*, Paris, France, June 2003.

Graduated with the highest distinction in Infrastructure and Transport from *École Supérieure d'Ingénieurs de Beyrouth*, Mar Roukoz, Lebanon, June 2002.

Received the highest ranking graduate award from *Université Saint-Joseph*, Mar Roukoz, Lebanon, June 2002.

RELEVANT
GRADUATE
COURSE WORK

Mathematical Modeling Linear System Theory Risk and Reliability Analysis Uncertainty Quantification	Advanced T&D ¹ of Reinforced Concrete Advanced T&D ¹ of Prestressed Concrete Analysis and Design of Composite Structures Civil and Industrial Steel Construction
Numerical Analysis Scientific Computing Finite Element Method Nonlinear Finite Element Analysis	Structural Analysis Plates and Shells Theory of Inelastic Structures Analysis and Design of Building Structures Advanced Design of Bridges
Continuum Mechanics Mechanics of Soft Materials Fluid Mechanics Hydraulics	Dams Special Works and Structures Underground Works and Tunneling Linear Infrastructures and Road Design
Intermediate Dynamics Advanced Structural Dynamics Earthquake Structural Engineering	General Construction Methods Industrialized Constructions
Geology Topography Soil and Rock Mechanics Environmental and Geotechnical Engineering A&D of Foundations and Retaining Structures	Sea and Air Transport Urban Transport
Environmental Impact Assessment Academic Writing	Quality Management in Construction Management and Planning of Large Scale Projects Marketing and Communication General and Analytical Accounting Financial Management of Firms

¹ Theory and Design

PUBLICATIONS

Refereed Journal Articles (published)

G.-P. Zéhil & H.P. Gavin (2013), "Three-dimensional boundary element formulation of an incompressible viscoelastic layer of finite thickness applied to the rolling resistance of a rigid sphere," *International Journal of Solids and Structures*, 50(6), 833–842.
DOI: 10.1016/j.ijsolstr.2012.11.020.

G.-P. Zéhil & H.P. Gavin (2013), "Simple algorithms for solving steady-state frictional rolling contact problems in two and three dimensions," *International Journal of Solids and Structures*, 50(6), 843–852.
DOI: 10.1016/j.ijsolstr.2012.11.021.

G.-P. Zéhil & H.P. Gavin (2013), "Simplified approaches to viscoelastic rolling resistance," *International Journal of Solids and Structures*, 50(6), 853–862.
DOI: 10.1016/j.ijsolstr.2012.09.025.

G.-P. Zéhil & H.P. Gavin (2013), "Unified constitutive modeling of rubber-like materials under diverse loading conditions," *International Journal of Engineering Science*, 62, 90–105.
DOI: 10.1016/j.ijengsci.2012.09.002.

P.S. Harvey, G.-P. Zéhil & H.P. Gavin (2014), "Experimental validation of simplified models for rolling isolation systems," *Earthquake Engineering and Structural Dynamics*, 43, 1067–1088.
DOI: 10.1002/eqe.2387.

G.-P. Zéhil & H.P. Gavin (2014), "Two and three-dimensional boundary element formulations of compressible isotropic, transversely isotropic and orthotropic viscoelastic layers of arbitrary thickness, applied to the rolling resistance of rigid cylinders and spheres," *European Journal of Mechanics – A/Solids*, 44, 175–187.

DOI: 10.1016/j.euromechsol.2013.10.015.

G.-P. Zéhil & H.P. Gavin (2014), "Rolling resistance of a rigid sphere with viscoelastic coatings," *International Journal of Solids and Structures*, 51, 822–838.

DOI: 10.1016/j.ijsolstr.2013.11.009.

Refereed Journal Articles (under review)

G.-P. Zéhil & H.P. Gavin, "On the structural behavior of casing-infill composite tubes: theory and experiment."

Refereed Journal Articles (in preparation)

G.-P. Zéhil & H.P. Gavin, "Experimental study of the resistance to motion incurred by a hard sphere rolling between two sheets of rubber: influence of material and geometric nonlinearities on the viscoelastic rolling resistance."

G.-P. Zéhil & X. Zhao, "A micro-physical model for the large deformation and damage of high-functionality networks."

CONFERENCE ABSTRACTS / PAPERS

G.-P. Zéhil & H.P. Gavin, "Full three-dimensional model for rolling resistance: hard sphere on viscoelastic foundation of finite thickness," 2012 Joint Conference of the Engineering Mechanics Institute and 11th ASCE Joint Specialty Conference on Probabilistic Mechanics and Structural Reliability, University of Notre Dame, Indiana, USA, June 17–20, 2012.

G.-P. Zéhil & H.P. Gavin, "Unified constitutive modeling of rubber-like materials under diverse loading conditions," 12th U.S. National Congress on Computational Mechanics, Raleigh, North Carolina, USA, July 22–25, 2013.

G.-P. Zéhil & H.P. Gavin, "New three-dimensional boundary element formulation of a viscoelastic layer of finite thickness applied to the rolling resistance of a rigid sphere," 12th U.S. National Congress on Computational Mechanics, Raleigh, North Carolina, USA, July 22–25, 2013.

H.P. Gavin, G.-P. Zéhil & P.S. Harvey, "Experimental verification of a rolling isolation system," 10th U.S. National Conference on Earthquake Engineering, Anchorage, Alaska, USA, July 21–25, 2014.

PRESENTATIONS AND SEMINARS

"Novel approaches to modeling viscoelastic materials and components; Rolling resistance; Synergistic structural composites," Florida Atlantic University, Boca Raton, Florida, USA, May 13, 2014.

"Novel approaches to modeling viscoelastic materials and components; Rolling resistance; Synergistic structural composites," Notre Dame University, Louaize, Lebanon, April 14, 2014 (by video conference).

"Novel approaches to modeling viscoelastic materials and components; Rolling resistance; Synergistic structural composites," The Catholic University of America, Washington DC, USA, February 19, 2014.

"Novel approaches to modeling viscoelastic materials and components; Rolling resistance; Synergistic structural composites," North Carolina State University, Raleigh, North Carolina, February 6, 2014.

"Novel approaches to modeling viscoelastic materials and components; Rolling resistance; Synergistic structural composites," University of Ottawa, Ottawa, Canada, January 24, 2014.

"Novel approaches to modeling viscoelastic materials and components; Rolling resistance; Synergistic structural composites," Clarkson University, Potsdam, New York, USA, December 9, 2013.

"Novel approaches to modeling viscoelastic materials and components; Rolling resistance; Synergistic structural composites," University of Colorado, Boulder, Colorado, USA, December 2, 2013.

"Combining the extradosed post-tensioning technique with the balanced segmental cantilever construction method," Lebanese University, Faculty of Engineering II, Ain Saadeh, Lebanon, January 21, 2010.

"Exceptional bridge crossing the Trois Bassins ravine on the French Réunion island: design and construction methodology," Université Saint-Joseph, Faculty of Engineering, Department of Civil and Environmental Engineering, Mar Roukoz, Lebanon, February 18, 2010.

"Polypropylene fibered concrete tunnel on the RN314 in La Défense: resistance to fire and blasting," Centre des Hautes Etudes de la Construction, Paris, France, February 2, 2008.

"Types of prestressing in bridge construction: a brief review," Centre des Hautes Etudes de la Construction, Paris, France, April 4, 2007.

"Bridge design and construction: update on the French expertise," UBIFRANCE, the French Agency for International Business Development, Paris, France, November 9, 2006.

"Combining longitudinal and transverse phasing in prestressed concrete bridges," COTEBA Engineering, Paris, France, October 27, 2006.

PROFESSIONAL
MEMBERSHIP

Member of the Lebanese Order of Engineers and Architects.

SERVICE

Reviewer for the following archival journals: International Journal of Solids and Structures, Computational Materials Science, Journal of Applied Mechanics (ASME), Journal of Tribology (ASME).

COMPUTER
SKILLS

Computer Languages: C, C++, VBA, HTML and basics in JavaScript.

Computer Programs: Matlab, Mathematica, Maple, Abaqus, Ansys, SAP, L^AT_EX, Microsoft Office Suite, Microsoft Project, Primavera, OpenOffice Suite, AutoCad.

French Structural and Finite Element Programs: ST1, PCP, CDS, OMC, OM3, NEOP, Robot Millennium, Pylostab.
