

CURRICULUM VITAE OF GIANLUCA CUSATIS

Department of Civil and Environmental Engineering - Northwestern University
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:: **EDUCATIONAL PREPARATION** – *Ph.D. degree* in Structural Engineering, Politecnico di Milano (Milan, Italy), March 2002. “*Laurea*”¹ degree in Structural Engineering, Politecnico di Milano (Milan, Italy), July 1998.

:: **PROFESSIONAL EXPERIENCE** – *Associate Professor* (August 2011 – Present); and *Research Associate* (June 2004 – July 2005); Department of Civil and Environmental Engineering, **Northwestern University** (Evanston IL, USA). *Associate Professor* (July 2011– August 2011) and *Assistant Professor* (August 2005 – June 2011); Department of Civil and Environmental Engineering, **Rensselaer Polytechnic Institute** (Troy NY, USA). *Research Associate* (April 2002 – June 2004); **Politecnico di Milano** (Milan, Italy).

:: **HONORS AND AWARDS** – Member; American Society of Civil Engineers – 2010. Member; Chi Epsilon Honor Society – 2009. Affiliate Member; American Society of Civil Engineers – 2005. Industry Stipend of Excellence Award, ConCreep, 2001.

:: RESEARCH – PUBLICATIONS²

Books, Monographs, and Book Chapters.

01. **G. Cusatis**. “The Lattice Discrete Particle Model (LDPM) for the Numerical Simulation of Concrete Behavior Subject to Penetration”. In *Materials under extreme loadings - Application to penetration and impact*. Wiley, May 2010, ISBN: 9781848211841.

Peer Reviewed Journal Articles – Submitted and/or in Preparation

03. X. Zhou and **G. Cusatis**. “A tetrahedral finite element with rotational degrees of freedom for Cosserat and Cauchy continuum problems” *ASCE Journal of Engineering Mechanics*. Under Review.

Peer Reviewed Journal Articles – Published

24. **G. Cusatis** and X. Zhou. “High-Order Microplane Theory for Quasi-Brittle Materials with Multiple Characteristic Lengths” *ASCE Journal of Engineering Mechanics*. 10.1061/(ASCE)EM.1943-7889.0000747 (Nov. 4, 2013).
23. J. Smith, **G. Cusatis**, D. Pelessone, Eric Landis, J. O’Daniels, and J. Baylot. “Lattice Discrete Particle Modeling of Ultra High-Performance Fiber-Reinforced Concrete for Projectile Penetration Simulations.” *International Journal of Impact Engineering*. Volume 65, March 2014, Pages 13–32
22. M. Alnaggar, **G. Cusatis**, and G. Di Luzio. “Lattice Discrete Particle Modeling of Alkali-Silica-Reaction (ASR) Deterioration of Concrete Structures.” *Cement and Concrete Composites Journal*. Volume 41, August 2013, Pages 45–59.
21. G. Di Luzio and **G. Cusatis**. “Solidification-Microprestress-Microplane (SMM) Theory for Concrete at Early Age. Theory, Validation and Application.” *International Journal of Solids and Structures*. International Journal of Solids and Structures, Volume 50, issue 6 (March 15, 2013), pp. 957-975.
20. E. A. Schauffert, **G. Cusatis**, Pelessone, D., O’Daniel, J., and Baylot, J. “Lattice Discrete Particle Model for Fiber Reinforced Concrete (LDPM-F): II Tensile Fracturing and Multiaxial Loading Behavior”. *ASCE Journal of Engineering Mechanics*. 2012, 138(7), 834–841.

¹ In the old Italian high educational system the “Laurea” degree was a five year degree equivalent to BS+MS degree.

² Underlined names are current or former students.

19. E. A. Schaufert and **G. Cusatis**. "Lattice Discrete Particle Model for Fiber Reinforced Concrete (LDPM-F): I Theory". *ASCE Journal of Engineering Mechanics*. 2012, 138(7), 826–833.
18. **G. Cusatis** and H. Nakamura. "Discrete modeling of concrete materials", Preface to the Special Issue on discrete models, *Cement and Concrete Composites*, 2011, 33, 865-866.
17. **G. Cusatis**, A. Mencarelli D. Pelessone, and J.T. Baylot. "Lattice Discrete Particle Model (LDPM) for Failure Behavior of Concrete. II: Calibration and Validation". *Cement and Concrete Composites*. 2011, 33(9), pp. 891-905.
16. **G. Cusatis**, D. Pelessone, and A. Mencarelli. "Lattice Discrete Particle Model (LDPM) for Concrete failure Behavior of Concrete. I: Theory". *Cement and Concrete Composites*. 2011, 33(9), pp. 881-890.
15. **G. Cusatis**. "Strain Rate Effects on Concrete Behavior". *International Journal of Impact Engineering*. 2011, 38(4), pp. 162-170.
14. G. Di Luzio and **G. Cusatis**. "Hygro-Thermo-Chemical Modeling of High Performance Concrete. II: Calibration and Validation". *Cement and Concrete Composites*. 2009, 31(5), pp. 309-324.
13. G. Di Luzio and **G. Cusatis**. "Hygro-Thermo-Chemical Modeling of High Performance Concrete. I: Theory". *Cement and Concrete Composites*. 2009, 31(5), pp. 301-308.
12. **G. Cusatis** and E. A. Schaufert. "Cohesive Crack Analysis of Size Effect". *Engineering Fracture Mechanics*. 2009, 76, pp. 2163-2173.
11. L. Cedolin and **G. Cusatis**. "Identification of Concrete Fracture Parameters through Size-Effect Experiments". *Cement and Concrete Composites*. 2008, 30, pp. 788-797.
10. L. Cedolin, **G. Cusatis**, S. Eccheli, and M. Roveda. "Capacity of Rectangular Cross Sections Under Biaxial Eccentric Loads", *ACI Structural Journal*, 2008, 105(2), pp. 215-224.
09. A. Beghini, **G. Cusatis**, and Z.P. Bažant. "Spectral Stiffness Microplane Model for Quasi-Brittle Composite Laminates: II. Validation and Calibration." *Journal of Applied Mechanics, ASME*, 2008, 75(2), pp. (021009)1-9.
08. **G. Cusatis**, A. Beghini, and Z.P. Bažant. "Spectral Stiffness Microplane Model for Quasi-Brittle Composite Laminates: I. Theory." *Journal of Applied Mechanics, ASME*, 2008, 75(2), pp. (021010)1-6.
07. L. Cedolin, and **G. Cusatis**. "Cohesive Fracture in Concrete: Theoretical Aspects and Experimental Evidence", *Studies and Researches - Politecnico di Milano*, ed. by A. Migliacci, P.G. Gambarova, and F. Mola, publ. by Starrylink (Brescia, Italy), 2007, Vol. 27, pp. 167-192.
06. **G. Cusatis** and L. Cedolin. "Two-scale Analysis of Concrete Fracturing Behavior." Invited paper for the special issue of *Engineering Fracture Mechanics*, 2007, 74(1-2), pp. 3-17.
05. L. Cedolin, **G. Cusatis**, S. Eccheli, and M. Roveda. "Biaxial bending of concrete columns: an analytical solution", *Studies and Researches - Politecnico di Milano*, ed. by A. Migliacci, P.G. Gambarova, and F. Mola, publ. by Starrylink (Brescia, Italy), 2006, Vol. 26, pp. 163-192.
04. **G. Cusatis**, Z.P. Bažant and L. Cedolin. "Confinement-Shear Lattice CSL Model for Fracture Propagation in Concrete." Invited paper for the special issue of *Computer Methods for Applied Mechanics and Engineering* entitled "Computational Modelling of Concrete", 2006, 195(52), pp. 7154-7171.
03. Z.P. Bažant, **G. Cusatis** and L. Cedolin. "Temperature Effect on Concrete Creep Modeled by Microprestress-Solidification Theory." *Journal of Engineering. Mechanics, ASCE*, 2004, 130(06), pp. 691-699.
02. **G. Cusatis**, Z.P. Bažant and L. Cedolin. "Confinement–Shear Lattice Model for Concrete Damage in Tension and Compression. II: Numerical implementation and Validation." *Journal of Engineering. Mechanics, ASCE*, 2003, 129(12), pp. 1449-1458.
01. **G. Cusatis**, Z.P. Bažant and L. Cedolin. "Confinement–Shear Lattice Model for Concrete Damage in Tension and Compression. I: Theory." *Journal of Engineering Mechanics, ASCE*, 2003, 129(12), pp. 1439-1448.

Articles in Conference Proceedings³

³ Articles with asterisk are in refereed proceedings

41. *M. Alnaggar, **G. Cusatis** and G.Di Luzio. "A Discrete Model for Alkali-Silika-Reaction in Concrete". 8th International Conference on Fracture Mechanics of Concrete and Concrete Structures (FraMCos-8), 10-14 March, 2013. Toledo, Spain.
40. *R. Rezakhani and **G. Cusatis** "Generalized Mathematical Homogenization of The Lattice Discrete Particle Model". 8th International Conference on Fracture Mechanics of Concrete and Concrete Structures (FraMCos-8), 10-14 March, 2013. Toledo, Spain.
39. E. Gal, R. Rezakhani and **G. Cusatis**, "Homogenization of Concrete Using the Lattice Discrete Particle Model (LDPM)", IASS-IACM 2012: 7th International Conference on Computational Mechanics for Spatial Structure, Sarajevo, Bosnia, 2-4 April 2012.
38. *G. Di Luzio, M. Alnaggar and **G. Cusatis** "Lattice Discrete Particle Modeling of Alkali-Silica-Reaction Effects to Concrete Structures", in the Proceedings of the Numerical Modeling – Strategies for Sustainable Concrete Structures-SSCS 2012, P. Rossi and J.L. Tailhan (eds); Aix en Provence, France, 2012, in CD.
37. *G. Di Luzio and **G. Cusatis**. "Calibration and Validation of a Numerical Model for Early-Age Damage Analysis", 2012 Structures Congress – 20th A&C Specialty Track. 29-31 March, 2012. Chicago (IL).
36. *J. Smith and **G. Cusatis**. "Calibration and Validation of the Lattice Discrete Particle Model for Ultra-High Performance Fiber Reinforced Concrete", 2012 Structures Congress – 20th A&C Specialty Track. 29-31. March 2012. Chicago (IL).
35. *M. Alnaggar and **G. Cusatis**. "Automatic Parameter Identification of Discrete Mesoscale Models with Application to the Coarse-Grained Simulation of Reinforced Concrete Structures.", 2012 Structures Congress – 20th A&C Specialty Track. 29-31. March 2012. Chicago (IL).
34. *E. Schaufert and **G. Cusatis**. "Simulation of the Multiaxial Loading behavior of Fiber Reinforced Concrete". Second RILEM International Conference on Strain Hardening Cementitious Composites (SHCC2-Rio). 12-14 December, 2011. Rio de Janeiro, Brazil.
33. G. Cusatis, M. Savoia, N. Buratti (2011) "Discrete lattice model for fiber reinforced concrete modeling" Proceedings of the XX conference of the Italian Association for Theoretical and Applied Mechanics (AIMETA), 12-15 Sept. 2011, Bologna, Italy. ISBN: 9788890634017, 9788890634000. Web: <http://www.lamc.ing.unibo.it/aimeta2011/indiceM.html>.
32. ***G. Cusatis**, G. Diluzio, and L. Cedolin. "Meso-Scale Simulation of Concrete: Blast and Penetration Effects and AAR Degradation". Performance, Protection and Strengthening of Structures under Extreme Loading – Applied Mechanics and Materials 2011, 82, pp. 75-80. Trans Tech Publications, Switzerland.
31. **G. Cusatis**, L. Zhang. "Immersed Solid Volume Method for the Analysis of Concrete Dams". NSF CMMI Research and Innovation Conference 2011. 4-7 January, 2011. Atlanta, USA.
30. **G. Cusatis**, L. Zhang, L. Han, D. Pelessone. "Towards the computational analysis of blast-induced debris dynamics". International Symposium on Military Aspects of Blast and Shock (MABS21). 3-8 October, 2010. Jerusalem, Israel.
29. ***G. Cusatis**, A. Mencarelli, D. Pelessone, and J. T. Baylot. "The Lattice Discrete Particle Model (LDPM) for the simulation of Uniaxial and Multiaxial Behavior of Concrete: Recent Results". 7th International Conference on Fracture Mechanics of Concrete and Concrete Structures (FraMCos 7), 23-28 May, 2010. Jeju, South Korea.
28. *G. Di Luzio, **G. Cusatis**, and L. Cedolin, "Numerical simulation of heat transfer and moisture transport in high performance concrete at early age". 7th International Conference on Fracture Mechanics of Concrete and Concrete Structures (FraMCos 7), 23-28 May, 2010. Jeju, South Korea.
27. ***G. Cusatis**, and E. A. Schaufert. "Discontinuous Cell Method (DCM) for Cohesive Fracture Propagation". 7th International Conference on Fracture Mechanics of Concrete and Concrete Structures (FraMCos 7), 23-28 May, 2010. Jeju, South Korea.
26. *Z. P. Bažant, **G. Cusatis**, Q. Yu, L. Cedolin, and M. Jirasek, "Misconceptions on Variability of Fracture Energy, Its Uniaxial Definition by Work of Fracture, and Dependence on Crack Length and Specimen Size". 7th International Conference on Fracture Mechanics of Concrete and Concrete Structures (FraMCos 7), 23-28 May, 2010. Jeju, South Korea.
25. G. Di Luzio, **G. Cusatis**, and L. Cedolin, "A numerical model for early age concrete behavior". EURO-C 2010: Computational Modeling of Concrete Structures. March 15-18, 2010. Rohrmoos/Schladming, Austria.

24. **G. Cusatis**, **E. A. Schaufert**, D. Pelessone, J. L. O'Daniel, P. Marangi, M. Stacchini, and M. Savoia. "Lattice Discrete Particle Model for Fiber Reinforced Concrete (LDPM-F) with Application to the Numerical Simulation of Armoring Systems". EURO-C 2010: Computational Modeling of Concrete Structures. March 15-18, 2010. Rohrmoos/Schladming, Austria.
23. Z. P. Bažant, Q. Yu, F. Caner, and **G. Cusatis**. "How to enforce non-negative energy dissipation in microplane and other constitutive models for softening damage, plasticity and friction". EURO-C 2010: Computational Modeling of Concrete Structures. March 15-18, 2010. Rohrmoos/Schladming, Austria.
22. Z. P. Bažant, Q. Yu, G.-H. Li, and **G. Cusatis**. "Modeling of Creep and Hygrothermal Deformations of Concrete, and Consequences of Nano-Porosity". Proceedings of the Fourth Biot Conference on Poromechanics. Columbia University, New York City, NY. June 8-10, 2009.
21. **G. Cusatis**, **A. Mencarelli**, D. Pelessone, and J. Bishop. "On the Meso-Scale Simulation of Blast and Penetration Effects on Structures". Electronic Proceedings (CD) of the International Symposium on the Interaction of the Effects of Munitions with Structures (ISIEMS) 13. 11-15 May 2009. Bruhel, Germany.
20. **G. Cusatis**, **A. Mencarelli**, and D. Pelessone "Mesoscale Modeling of Debris Generation in Reinforced Concrete Structures". Proceedings of the Inaugural International Conference of the Engineering Mechanics Institute (EM08), University of Minnesota, Minneapolis, Minnesota, May 18-21, 2008.
19. E. A. Schaufert and **G. Cusatis**. "Cohesive Fracture and the Effective Fracture Process Zone Length". Proceedings of the Inaugural International Conference of the Engineering Mechanics Institute (EM08), University of Minnesota, Minneapolis, Minnesota, May 18-21, 2008.
18. **G. Cusatis**, D. Pelessone, and J. T. Baylot. "Dynamic Pull-out Test Simulations Using the Lattice Discrete Particle Model (LDPM)". Proceedings of the 2008 ASCE Structures Congress, April 24-26, 2008, Vancouver, Canada.
17. **G. Cusatis**, A. Mencarelli, D. Pelessone, and J. T. Baylot. "Lattice Discrete Particle Model (LDPM) for Fracture Dynamics and Rate Effect in Concrete". Proceedings of the 2008 ASCE Structures Congress, April 24-26, 2008, Vancouver, Canada.
16. **G. Cusatis**, D. Pelessone, A. Mencarelli, and J. T. Baylot. "Simulation of Reinforced Concrete Structures Under Blast And Penetration Through Lattice Discrete Particle Modeling". Electronic Proceedings (CD) of IMECE 2007 - ASME International Mechanical Engineering Conferences & Exposition, November 11-15, 2007, Seattle, USA.
15. D. Pelessone, **G. Cusatis**, and J. T. Baylot. "Application of the Lattice Discrete Particle Model (LDPM) to Simulate the Effects of Munitions on Reinforced Concrete Structures". Electronic Proceedings (CD) of the International Symposium on the Interaction of the Effects of Munitions with Structures (ISIEMS) 12.1, September 17-21, 2007, Orlando, FL, USA.
14. **G. Cusatis**, A. Mencarelli, D. Pelessone, and J. T. Baylot. "Lattice Discrete Particle Model (LDPM): Formulation, Calibration, and Validation". Electronic Proceedings (CD) of the International Symposium on the Interaction of the Effects of Munitions with Structures (ISIEMS) 12.1, September 17-21, 2007, Orlando, FL, USA.
13. *L. Cedolin and **G. Cusatis**. "Cohesive fracture and size effect in concrete". Fracture Mechanics of Concrete and Concrete Structures. Volume 1: New Trends in Fracture Mechanics of Concrete (Proceedings of the Sixth International Conference on Fracture Mechanics of Concrete and Concrete Structures – FraMCoS-6). Catania, Italy. June 18-21, 2007. ISBN 978-0-415-44065-3. pp. 17-29.
12. **G. Cusatis** and Z.P. Bažant. "Size effect on compression fracture of concrete with or without V-notches: a numerical meso-mechanical study". Proceedings of the EURO-C 2006 Conference on Computational Modelling of Concrete Structures, 27-30 March 2006, Mayrhofen, Tyrol, Austria. ISBN 10: 0 415 39749 9. pp. 71-76.
11. P. Grassl, Z.P. Bažant, and **G. Cusatis**. "Lattice-cell approach for modeling fracture". Proceedings of the EURO-C 2006 Conference on Computational Modelling of Concrete Structures, 27-30 March 2006, Mayrhofen, Tyrol, Austria. ISBN 10: 0 415 39749 9. pp. 263-268.
10. **G. Cusatis** and D. Pelessone "Mesolevel simulation of reinforced concrete structures under impact loadings". Proceedings of the EURO-C 2006 Conference on Computational Modelling of Concrete Structures, 27-30 March 2006, Mayrhofen, Tyrol, Austria. ISBN 10: 0 415 39749 9. pp. 63-70.

09. L. Cedolin, **G. Cusatis**, S. Eccheli, and M. Roveda. "On the failure envelope of reinforced concrete cross sections subjected to biaxial bending and axial load: an analytical solution". Electronic Proceedings (CD) of the Second FIB Congress, 5-8 June 2006, Naples, Italy.
08. Z.P. Bažant, and **G. Cusatis**. "Concrete creep at high temperature and its interaction with fracture: recent progress" Creep, shrinkage and durability of concrete and concrete structures. (Proceedings of the 7th International Conference CONCREEP-7, Nantes, France, 12-14 September 2005. Pijaudier-Cabot Gilles, Gérard Bruno, and Acker Paul eds., pp. 449-459.
07. Z.P. Bažant, and **G. Cusatis**. "Creep diffusion and fracture in heated concrete structures: recent progress" Proceedings of the 6th International Congress on Thermal Stresses. 26-29 May 2005, Vienna, Austria. F. Ziegler, R. Heuer, C. Adam, eds, Vienna University of Technology, Austria, pp. 15-22.
06. ***G. Cusatis**, M. Polli and L. Cedolin. "Mesolevel analysis of fracture tests for concrete." Fracture Mechanics of Concrete Structures (Proceedings of the Fifth International Conference on Fracture Mechanics of Concrete and Concrete Structures – FraMCoS-5). Vail Cascade Resort, Vail Colorado, USA. V.C. Li, C.K.Y. Leung, K.J. Willam, S.L. Billington, ed., Ia-FraMCoS, USA, April 2004. ISBN 0-87031-135-2, pp. 345-351.
05. *Z.P. Bažant, F.C. Caner, L. Cedolin, **G. Cusatis** and G. Di Luzio. "Fracturing Material Models Based on Micromechanical Concepts: Recent Advances." Fracture Mechanics of Concrete Structures (Proceedings of the Fifth International Conference on Fracture Mechanics of Concrete and Concrete Structures – FraMCoS-5). Vail Cascade Resort, Vail Colorado, USA, April 2004. V.C. Li, C.K.Y. Leung, K.J. Willam, S.L. Billington, ed., Ia-FraMCoS, USA, ISBN 0-87031-135-2, pp. 83-89.
04. *G. Di Luzio and **G. Cusatis**. "A New Constitutive Model for Concrete-Steel Bond Behavior." Computational Modeling of Concrete Structures (Proceedings of the EURO-C 2003 Conference). St. Johann im Pongau, Austria, March, 2003. N. Bićanić, R. de Borst, H. Mang, G. Meschke, ed., A.A. Balkema, The Netherlands, ISBN 9058095363, pp. 281-286.
03. ***G. Cusatis**, G. Di Luzio and M. Rota. "Simulation of Headed Anchor Failure." Computational Modeling of Concrete Structures (Proceedings of the EURO-C 2003 Conference). St. Johann im Pongau, Austria, March 2003. N. Bićanić, R. de Borst, H. Mang, G. Meschke, ed., A.A. Balkema, The Netherlands, ISBN 9058095363, pp. 683-688.
02. ***G. Cusatis**, Z.P. Bažant and L. Cedolin. "3D Lattice model for dynamic simulations of creep, fracturing and rate effect in concrete." Creep, shrinkage and durability mechanics of concrete and other quasi-brittle materials. (Proceedings of the 6th International Conference CONCREEP-6, MIT, Cambridge (MA), USA, August 2001. F.-J. Ulm, Z.P. Bažant and F.H. Wittmann, eds., Elsevier, Amsterdam, ISBN 0080440029, pp. 113-118.
01. *Z.P. Bažant, L. Cedolin and **G. Cusatis**. "Temperature effect on concrete creep modeled by Microprestress-Solidification theory." Creep, shrinkage and durability mechanics of concrete and other quasi-brittle materials. (Proceedings of the 6th International Conference CONCREEP-6, MIT, Cambridge (MA), USA, August 2001. F.-J. Ulm, Z.P. Bažant and F.H. Wittmann, ed., Elsevier, Amsterdam, ISBN 0080440029, pp. 197-204.

:: RESEARCH – PROJECTS

@ Northwestern University (Evanston, IL)

Sponsored Research Projects: **(4)** Microplane Constitutive Model for Carbon-Polymer Laminates and Prediction of Car Crashworthiness. 12/12-12/14. DOE via USCAR. **(3)** Ultra-High Performance Fiber Reinforced Concrete Structures - Macroscale Analysis with Mesoscale Lattice Discrete Particle Models. 8/12-7/15, NSF. **(2)** Microscopic Computational Simulation of Fiber-Matrix Interaction in Ultra High-Performance Cementitious Composites Under Quasi-Static and Dynamic Loadings. 8/12-8/13. USACE ERDC. **(1)** Numerical Simulation of the Micromechanical Behavior of Fiber/Concrete Interaction. 10/12-10/14. USACE ERDC via ES3 SBIR Phase II Project.

Projects Transferred from RPI: **(3)** High Strain Rate Behavior of Dam Concrete: Experiments and Multiscale Modeling. DHS. 4/10-4/12. **(2)** Man-made Hazard Mitigation of Reservoir Dams: Monte Carlo Simulation with Multiscale Modeling of Concrete and Accurate Fluid-Structure Interaction. NSF. 7/0-7/13. **(1)** A Multiscale Multiphysics Computational Framework for the Simulation of Blast Induced Pervasive Failure. DTRA. 4/09-4/12.

Internal Seed Grants and Research Projects Supported on Start-Up Funds: **(4)** Energy recovery and fracture in granular rocks: towards a new generation of multi-scale simulators, ISEN, 7/1/2013-6/31/2013. **(3)** Fungi-Activated Self-

Healing Cement Paste for Sustainable Civil Engineering Infrastructure Materials, CEE, 4/1/2013- 4/1/2014. (2) Bridging Scale Method formulation for the Simulation of Projectile Penetration into Concrete Structures, Start-up, 5/12-12/12. (1) Characterization of the Mechanical Behavior of CorTuf Concrete at Early-Age and Beyond, Start-up, 9/12-9/13.

@ Rensselaer Polytechnic Institute (Troy, NY)

Sponsored Research Projects: (9) High Strain Rate Behavior of Dam Concrete: Experiments and Multiscale Modeling. DHS. 4/10-4/12. (8) Mesoscale Based Formulation of Microplane Model. USACE ERDC. 8/09-8/11. (7) Man-made Hazard Mitigation of Reservoir Dams: Monte Carlo Simulation with Multiscale Modeling of Concrete and Accurate Fluid-Structure Interaction. NSF. 7/09-7/12. (6) A Multiscale Multiphysics Computational Framework for the Simulation of Blast Induced Pervasive Failure. DTRA. 4/0-94/12. (5) An Adaptive Multiscale Framework for the Simulation of Fiber-Reinforced High-Performance Concrete Subjected to High Speed Penetration. 9/08-9/09. USACE ERDC via ES3. (4) Microplane Modeling of Size-Effect in Composite Laminates. 5/08-9/08. ONR via Northwestern University. (3) Microplane Model for Stochastic Heterogeneous Quasi-Brittle Media. 5/08-9/08. NSF via Northwestern University. (2) Mesoscale and Macroscale Approaches for the Simulation of Quasi-Brittle Fracture. 4/8/08. Sandia National Lab. (1) Constitutive Modeling and Numerical Algorithms for Concrete Behavior at High Strain Rate. 10/05-8/07. USACE ERDC via ES3.

Research Projects Supported on Start-Up Funds: (4) Discontinuous Cell Method (DCM). 9/07-12/09. (3) Spectral Particle Method (SPM). 1/06-8/07. (2) Lattice Discrete Particle Model (LDPM) for Concrete. 1/06-8/09. (1) Size Effect and Cohesive Crack Propagation in Quasi-Brittle Materials. 1/06-1/08.

Collaborations in Other Research Projects: (2) Concrete Cracking Simulation at the Early-Ages. 8/05-8/06. PI: L. Cedolin (Politecnico di Milano University, Milan, Italy). CIS-E Consortium, Milan, Italy. (1) Microplane Model for Composite Laminates. 6/04-1/06. PI: Z.P. Bažant (Northwestern University, Evanston, IL). Office of Naval Research.

@ Politecnico di Milano (Milan, Italy)

Collaborations in Other Research Projects: (4) Theoretical and Experimental Study of the Behavior of Reinforced-Concrete Structures. 4/02-6/04. PI: P. Gambarova. Italian Minister of University and Research. (3) Adhesive Fastener Project (I-II-III). 11/01-4/03. PI: L. Cedolin. Hilti Corporation. (3) UE Anchor Project: Anchorages in Normal and High-Performance Concretes Subjected to Medium and High Strain Rates. 3/99-3/01. PI: L. Cedolin. European Union. (2) Confinement-Shear Lattice Model for Concrete. 9/98-3/02. PI: L. Cedolin. Italian Minister of University and Research. (1) Microprestress-Solidification Theory for Drying and Transitional Thermal Creep. 4/97-7/98. PI: L. Cedolin. Politecnico di Milano

:: TEACHING AND SUPERVISING –

@ Northwestern University (Evanston IL, USA)

Grad Courses: (3) Structural Engineering and Infrastructure Materials (SEIM) seminar series, Sep 2011 - Present; (2) Theory of Plates and Shells, Spring 2012; Winter 2013; (1) Prestressed Concrete, Spring 2012, Spring 2013.

Post-Docs: (3) Congrui Jin, October 2013 – Present; (2) Roman Wendner, July 2012 – August ; (1) Xinwei Zhou, May 2012 – February 2013.

PhD Students: (5) Lin Wan, “Material Characterization of Infrastructure Materials (*tentative*)” (4) Shiva Esna Ashari Esfahani, “Multiscale Modeling of Earth-like Materials (*tentative*)”, In progress; (3) Jovanca Smith, “Ultra-High Performance Concrete for Impact Resistant Structures: Computation and Experimental Characterization”, In progress; (2) Roozbeh Rezhakani, “Mathematical Homogenization of Discrete Models for the Simulation of Quasi-Brittle Behavior”, In progress; (1) Mohammed Al-Naggar, “Multiscale Modeling of Concrete for Failure Analysis and Aging of Concrete Structures”.

MS Students: (4) Faysal Bousikhane, “Experimental investigation of a fungi-activated self-healing concrete”; (3) Jiannan Wang, “Computational Analysis of Concrete-Fiber Interaction”; (2) Yikai Wang, “Strength and Toughness Build-Up of Ultra-High Performance Concrete”; (1) Laure Bonfils, “Dynamic Behavior of Ultra-High Performance Concrete (UHPC) Structures Under Extreme Loading Conditions”, May 2013.

@ Rensselaer Polytechnic Institute (Troy NY, USA)

Grad Courses: (1) Advanced Concrete Mechanics in Fall 2008, 2010;

Undergrad Courses: (4) Strength of Materials in Fall 2010; (3) Concrete Design in Spring 2007, 2009, 2010, 2011, 2012; (2) Advanced Structural Analysis in Spring 2006, 2008, 2010; (1) Introduction to Structural Engineering in Fall 2009, 2008, 2007, 2006, 2005.

Independent Studies: (8) Modern Protective Structures in Spring 2011; (7) Fiber Reinforced Concrete in Spring 2011; (6) Fiber Reinforced Cementitious Composites in Fall 2010; (5) Steel Bridge Design in Fall 2010; (4) Experimental Concrete Mechanics in Fall 2009. (3) Experimental Concrete Mechanics in Fall 2008; (2) Introduction to Bridge Engineering in Fall 2007; (1) Mechanics of Concrete in Spring 2007.

Developed Courses: (2) **Advanced Concrete Mechanics**, CIVL 6830. *Course Objective:* The objective of this course is to introduce graduate and senior undergraduate students to advanced topics on the mechanics of concrete behavior. Students will do this by building on the knowledge gained through all mechanics related courses of the undergraduate curriculum (statics, mechanics of materials, concrete design, etc.). Upon successful completion of the course, students will have an advanced understanding of concrete behavior as well as knowledge of specific modeling theories that can be used for the numerical simulation of concrete structures. Having successfully completed this course, students will have the necessary skills to conduct concrete research as well as to solve advanced concrete design problems. *Topics:* Mechanics of concrete failure under uniaxial and multiaxial stress states. Strain-softening behavior and damage localization in tension and compression. Nonlinear strain-hardening behavior under triaxial compression. Tensile fracture and size-effect. Constitutive modeling of concrete mechanical behavior. Cohesive crack model. Plasticity models, damage models, microplane models, and discrete models. (1) **Advanced Structural Analysis**, CIVL 4440 and CIVL 6440. *Course Objective:* The objective of this course is to develop a working knowledge on matrix analysis of elastic structures, plastic behavior of structures, buckling of elastic structures. Students will do this by building on the knowledge gained through IEA (ENGR 1100) and introduction to structural engineering (CIVL 2670). Upon successful completion of the course, students will have an adequate insight of elastic, plastic, and buckling behavior of structures as well as specific structural analysis tools needed in the professional practice of modern structural engineers. *Topics:* Computer Analysis of structures. Advanced topics in the behavior of structural components. Bending of plates, buckling of columns and frames. Beam-columns. Torsion in structural members. Inelastic behavior and limit analysis of structures.

Post-Docs: (2) Andrea Mencarelli, November 2010 – December 2010; (1) Edward Schauffert, September 2010 – August 2011

PhD Students: (3) Xinwei Zhou, “Continuous/Discrete Computational Modeling for the Multiscale Simulation of Concrete Mechanical Behavior”, May 2012; (2) Andrea Mencarelli, “Numerical Simulation of the Effect of Blast and Penetration on Reinforced Concrete Structures”, November 2010; (1) Edward A. Schauffert, “Discrete Modeling of Quasi-Brittle Materials: Fracture, Fragmentation and Size-Effect”, August 2010.

MS Students: (7) Eric Domonell, “Lattice Discrete Particle Modeling of Reinforced Concrete”, December 2011. (6) Jovanca Smith, “Discrete Modeling of Ultra High-Strength, Fiber Reinforced Concrete”, August 2011. (5) Eric Dhal, “Experimental Investigation of the Mechanical Behavior of Concrete under Uniaxial and Multiaxial Stress States”, November 2009. (4) Daniel Horvath, “Microplane Modeling of Concrete and Other Quasi-Brittle Materials”, November 2009. (3) Andrea Mencarelli “Discrete Particle Model (LDPM) for Concrete: Calibration and Validation under Quasi-Static Loading Condition”, December 2007. (2) Edward Schauffert, “Size Effect and Cohesive Crack Propagation in Quasi-Brittle Materials”, August 2007. (1) Miao Zhou “Spectral Particle Method (SPM) for Two-dimensional Cohesive Crack Propagation”, August 2007.

:: SERVICE AND LEADERSHIP –

Membership in Professional Societies

- International Association of Protective Structures (IAPS), September 2011 – Present.
- RILEM, International Union of laboratories and Experts in Construction Materials, Systems and Structures, Member, May 2010 – Present.
- American Society of Civil Engineering (ASCE), Member, August 2006 – Present
- American Concrete Institute (ACI), Member, August 2005 – Present
- United States Association for Computational Mechanics (USACM), Member, August 2009 – August 2010
- The Milan Order of Engineers, Member, 1999 – 2006

Service in Technical Committees and Technical Boards

- Associate Editor for the Engineering Mechanics Journal (JEM) of the ASCE. December 2012 – Present.
- ACI 446 Fracture Mechanics, Chair, March 2010 – Present. Member since September 2005.
- ACI Committee on Awards for Papers (CAP) – Subcommittee SC2, Wason Medal for Materials Research, Member, February 2013 – Present.
- FraMCoS (Fracture Mechanics of Concrete and Concrete Structures), Treasurer and Board Member, March 2013 – Present.
- ASCE EMI – Computational Mechanics, Member, April 2008 – Present.
- ASCE EMI – Modeling Inelasticity and Multi-Scale Behavior, Member, May 2008 – Present.
- ACI 209, Creep and Shrinkage in Concrete, Member, May 2008 – Present.
- ACI 447 Finite Element Analysis of Reinforced Concrete Structures (Joint ACI-ASCE), Member, April 2008 – Present.
- IA-CONCREEP, Board of Directors, Secretary, October 2008 – September 2012.

Chairmanship at Conferences and Workshops

- EMI 2013, ASCE Engineering Mechanics Institute Conference, 4-7 August, 2013, Evanston (IL), USA. Conference Chair.
- SES 2012, Society of Engineering Science – 49th Annual Technical Meeting, 10-12 Oct, 2012, Atlanta (GA), USA. “Symposium IV.15 From Nanopores to Large Structures: A Life Time Journey Across Length Scales.” A 75th Birthday Symposium celebrating Professor Bažant’s contributions to the fundamental understanding of the behavior of solid materials and structures across multiple time and length scales.” In honor of Prof. Z.P. Bažant. Organizer and Session Chairman.
- EMI 2010, ASCE Engineering Mechanics Institute Conference, 8-11 August, 2010, Los Angeles (CA), USA. Mini-symposium on “Constitutive and Fracturing Behavior of Quasi-Brittle Materials Computation and Experiments” in honor of Prof. L. Cedolin. Organizer and Session Chairman.
- 7th International Conference on Fracture Mechanics of Concrete and Concrete Structures (FraMCoS 7), 23-28 May, 2010, Jeju, South Korea. Two sessions on “Discrete Modeling of Concrete Materials and Structures”, Session Organizer and Session Chairman.
- 10th U.S. National Congress for Computational Mechanics, Mini-symposium on Structural Response Under Extreme Loads: Modeling, Simulation, and Experiments, Columbus (OH), July 16-19, 2009, Session Organizer and Session Chairman.
- The 2009 Joint ASCE-ASME-SES Conference on Mechanics and Materials, Symposium in Honor of Z. P. Bažant, Blacksburg (VA), June 24-27, 2009, Session Chairman.
- Mini-symposium on Failure Simulation by Discrete Models, CFRAC 2007, International Conference on Computational Fracture and Failure of Materials and Structures, Nantes, France, June 11 – 13, 2007, Session Chairman.

Service @ Northwestern University (Evanston, IL)

- Faculty Advisory Committee, CEE Department, September 2013 - Present
- Coordinator for the Seminar Series on “Structural Engineering and Infrastructure Materials (SEIM): Design, Mechanics, and History.” AY 2012 – Present.

- Area Coordinator for the Structural Engineering and Infrastructure Materials (SEIM) program. Aug. 2011 – Present.

Service @ Rensselaer Polytechnic Institute

- Geotechnical/Environmental Eng. Search Committee, Member, Jan. 11 – May 11.
- CEE Graduate Committee, Member, Sep. 2008 – May 2011.
- 175th Anniversary Celebration Committee, Member, Sep. 2009 – May 2010.
- Faculty Peer Support Committee, Member, Sep. 2008 – Sep. 2009.
- Faculty Mentorship Committee, Chair, Jan. 2008 – Sep. 2008.
- Departmental Undergraduate Committee, Member, Jan. 2008 – Sept. 2008.
- Faculty advisor for the Chi-Epsilon Student Chapter, May 2010 – May 2011.
- Advisor for the RPI Concrete Canoe Team, Fall 2010 – Spring 2011.
- Advisor for the RPI Steel Bridge Team, Fall 2006 – Spring 2011.

Professional and Public Lectures

Short Courses (4): “MARS: Modeling and Analysis of the Response of Structures”. Rensselaer Polytechnic Institute, Troy (NY), USA, September 2010. “Cracking of Prestressed Concrete Bridges”. NYSDOT. Bridge Inspection Training Course. Birch Hill, Schodack, NY, March 2010. “Design of Prestressed Concrete Bridges”. NYSDOT Training Course. Rensselaer Polytechnic Institute, Troy (NY), USA, May 2007. “Modeling and Analysis of the Response of Structures (MARS) Workshop: the Lattice Discrete Particle Model (LDPM)”. U.S. Army Engineer Research & Development Center, Vicksburg (MS), USA, April 2007.

Invited Lectures (29): Hilti Corporation, Schaan, Lichtenstein, June 3 2013. “High-order Microplane Theory for Elasticity and Softening of Quasi-Brittle Materials” **Keynote Lecture** at The Third International Conference on Computational Modeling of Fracture and Failure of Materials and Structures (C-FRAC 2013), Prague, Czech Republic, 4-7 June 2013. “Simulation of Fiber-Reinforced Ultra-High Performance Concrete Under Penetration” **Keynote Lecture** at the PREVI Workshop, Les Houches, France, 1-4 April, 2013. “Generalized Mathematical Homogenization of The Lattice Discrete Particle Model”. **Keynote Lecture** at the 8th International Conference on Fracture Mechanics of Concrete and Concrete Structures (FraMCoS-8), 10-14 March, 2013. Toledo, Spain. “Multiscale Modeling of Concrete (and Other Geomaterials): Are We There Yet? Sandia Nat Labs”, Albuquerque (NM), Sep. 5 2012. “Multiscale And Multiphysics behavior of Concrete: Predicting Infrastructure Future?” US Bureau of Reclamation, Denver (CO), July 20, 2012. “Modeling the Multiscale and Multiphysics Behavior of Concrete: From Academia to Practice”, CTL Group, Skokie (IL), April 2012. “Discrete Modeling of Fiber Reinforced Concrete: Current Status and Future Outlook”, Structural Mechanics Seminar, Departments of Civil and Mechanical Engineering, University of Maine, USA, Feb 2011. “Multiscale and Multiphysics Modeling of Concrete”, Northwestern University, Evanston (IL), USA, Jan 2011. “Lattice Discrete Particle Model for Fiber Reinforced Concrete (LDPM-F)”, Politecnico di Milano, Milan, Italy, Dec. 2009.) “The Lattice Discrete Particle Model (LDPM) for the Simulation of Concrete under Extreme Loading Events. Current Status and Future Outlook”, Sandia National Laboratories. Albuquerque (NM), USA, Sep. 2009. “Modeling Concrete Failure Behavior under Quasi-Static and Dynamic Loading Conditions: A Discrete Mesoscale Approach”, Cornell University, Ithaca (NY), USA, Mar. 2009. “Microplane and Discrete Modeling of Quasi-Brittle Materials”, Politecnico di Milano, Milan, Italy, Dec. 2008. “Mesoscale Discrete Modeling of Fracture and Fragmentation for the Simulation of Concrete Structures Subjected to Extreme Loading Conditions”, University of Bologna, Bologna, Italy, Dec. 2008. “Discrete Modeling of Quasi-Brittle Fracture and Fragmentation: Recent Advances”. Warren Lecture Series, University of Minnesota, Minneapolis (MN), USA, Oct. 2008. “Meso-Scale Discrete Modeling of Reinforced Concrete Structures Subjected to Penetration: Recent Advances”. Materials under Extreme Loadings – Application to Penetration and Impact. The second US-France conference organized by the International Center for Applied Computational Mechanics. Rocamadour, France. May 2008. “Ten Years of Discrete Modeling of Concrete Behavior: Achievements and Future Challenges”. Politecnico di Milano, Milan, Italy, May 2008. “Discrete Modeling of Fracture and Fragmentation of Concrete Subjected to Impact and Penetration”. Penn State University, State College (PA), USA, Mar. 2008. “Discrete Modeling of Quasi-Brittle Fracture and Fragmentation: Current Trends and Future Outlook”. Theoretical and Applied Mechanics Colloquia, Northwestern University, Evanston (IL), USA, Mar. 2008. “Discrete Models for the Simulation of Concrete Behavior”. ZPB70Workshop, Prague, Czech Republic, Jun. 2007. “Lattice Discrete Particle Model (LDPM) for the Simulation of Reinforced Concrete Structures under High-Impulsive

Loadings." International Conference on Computational Fracture and Failure of Materials and Structures, Nantes, France, Jun. 2007. "Lattice Discrete Particle Model (LDPM) for the Simulation of Reinforced Concrete Structures under Extreme Loading Conditions." Institute for Advanced Technology, University of Texas at Austin, Austin (TX), USA, Mar 2007. "Mesolevel Modeling of Concrete Structures Subjected to Extreme Loading Conditions." Northwestern University. Evanston (IL), USA, Jul. 2006. "A Framework for the Analysis of Transverse Cracking in Composite Bridges." New York Department of Transportation. Albany (NY), USA, Jun. 2006. "Mesolevel Modeling of Concrete and Applications." University of California at Davis. Davis (CA), USA, Mar. 2006. "A Computational Framework for Quasi-Brittle Fracture and Fragmentation of Concrete Structures." Sandia National Laboratories. Albuquerque (NM), USA, Dec. 2005. "Explicit interface constitutive model with application to mesolevel analysis of concrete fracture." FraMCoS-5 2004, Fifth International Conference on Fracture Mechanics of Concrete and Concrete Structures Workshop 2: Interface Modelling. Vail Cascade Resort, Vail (CO), USA, Apr. 2004. "Mesosstructural analysis of the fracturing behavior of quasi-brittle materials." Department of Civil Engineering. University of Brescia, Brescia, Via Branze, 38 – 25123 Brescia, Italy, Feb. 2004. "Shear-confinement lattice model: a new mesolevel constitutive law for Concrete." Department of Geomaterials, Barcelona Politechnique (UPC). Barcelona, Spain, Apr. 2003.

Research Presentations at International Conferences, Symposia, and Workshops (13): "Multiscale Modeling of Projectile Penetration Into Concrete Targets", 14th International Symposium on Interaction of Munitions with Structures (ISIEMS). Seattle, Washington (USA), Sep. 2011. "Myth and Reality of Multiscale Modeling of Concrete and other Quasi-Brittle Materials", 14th International Symposium on Interaction of Munitions with Structures (ISIEMS). Seattle, Washington (USA), Sep. 2011. "Discontinuous Cell Method (DCM) for Cohesive Fracture Propagation". 7th International Conference on Fracture Mechanics of Concrete and Concrete Structures (FraMCoS 7), Jeju, South Korea, May 2010. "Meso-scale Modeling of Blast and Penetration Induced Fragmentation". Particles 2009 International Conference on Particle-Based Methods. Barcelona, Spain, Nov. 2009. "On the Meso-Scale Simulation of Blast and Penetration Effects on Structures". International Symposium on the Interaction of the Effects of Munitions with Structures (ISIEMS) 13. Bruehl, Germany, May 2009. "Meso-Scale Discrete Modeling of Concrete: Recent Advances", Plasticity 2009, St. Thomas, Virgin Islands, USA, Jan. 2009. "Lattice Discrete Particle Model (LDPM): Formulation, Calibration, and Validation". International Symposium on the Interaction of the Effects of Munitions with Structures (ISIEMS) 12.1, Orlando (FL) USA, Sep. 2007. "Microplane Model for Composite Laminates", International Conference on Modelling of Heterogeneous Materials with Applications in Construction and Biomedical Engineering, Prague, Czech Republic, June 2007. "Size effect on compression fracture of concrete with or without V-notches: a numerical meso-mechanical study". Conference on Computational Modelling of Concrete Structures, Mayrhofen, Tyrol, Austria, Mar. 2006. "Mesolevel simulation of reinforced concrete structures under impact loadings". Conference on Computational Modelling of Concrete Structures, Mayrhofen, Tyrol, Austria, Mar, 2006. "Mesolevel analysis of fracture tests for concrete." Fifth International Conference on Fracture Mechanics of Concrete and Concrete Structures – FraMCoS-5. Vail Cascade Resort, Vail (CO) USA, Apr. 2004. "Simulation of Headed Anchor Failure." Computational Modeling of Concrete Structures, EURO-C 2003 Conference. St. Johann im Pongau, Austria, Mar. 2003. "3D Lattice model for dynamic simulations of creep, fracturing and rate effect in concrete." 6th International Conference CONCREEP-6, MIT, Cambridge (MA), USA, Aug. 2001.

Research Presentations at National Conferences, Symposia, and Workshops (13): "Generalized Mathematical Homogenization of Discrete Fine-Scale Models for the Simulation of Heterogeneous Quasi-Brittle Materials", 49th Annual Technical Conference of Society of Engineering Science. Atlanta, GA (USA), Oct. 2012. "Multiscale Modeling of Projectile Penetration Into Concrete", 48th Annual Technical Conference of Society of Engineering Science. Evanston, IL (USA), Oct. 2011. "Discontinuous Cell Method (DCM) for Cohesive Fracture Propagation – Towards a Unified Discrete/Continuum Mechanics Theory", Sixth M.I.T. Conference on Computational Fluid and Solid Mechanics Cambridge (MA), USA, June 2011. "Multiscale Modeling of Concrete Structures through a Coarse-Grained Meso-Scale Model", EMI 2011: ASCE Engineering Mechanics Institute Conference, Boston (MA), USA, June 2011. "Discontinuous Cell Method (DCM) for Elasticity and Cohesive Fracture", EMI 2010: ASCE Engineering Mechanics Institute Conference, Los Angeles (CA), USA, Aug. 2010. "Lattice Discrete Particle Model for Fiber Reinforced Concrete (LDPM-F)", EMI 2010: ASCE Engineering Mechanics Institute Conference, Los Angeles (CA), USA, Aug. 2010. "Size-Effect Methods for Identification of Cohesive Crack Model Parameters", ACI Fall 2009 Convention, New Orleans (LA), USA, Nov. 2009. "The Lattice Discrete Particle Model (LDPM): Achievements and Current Research Thrusts", Multiscale Science and Engineering Center (MSEC) Seminar Series, Rensselaer Polytechnic Institute, Troy (NY), Sep. 2009. "Penetration of Reinforced Concrete Structures: a Meso-Scale Approach". 10th U.S. National Congress for

Computational Mechanics, July 16-19, 2009, Columbus (OH), Jul. 2009.) "Numerical Simulation of Blast and Penetration Effects on Structures". The 2009 Joint ASCE-ASME-SES Conference on Mechanics and Materials Symposium in Honor of Z. P. Bažant, June 24-27, 2009, Blacksburg (VA), Jun. 2009. "Lattice Discrete Particle Model (LDPM) for Fracture Dynamics and Rate Effect in Concrete". 2008 ASCE Structures Congress, April 24-26, 2008, Vancouver, Canada, Apr. 2008. "Two-scale Study of Concrete Fracturing Behavior", Multiscale Science and Engineering Center (MSEC) kick-off workshop, Rensselaer Polytechnic Institute, Troy (NY), Nov. 2006. "Mesolevel Simulation of Reinforced Concrete Structures Under Impact Loadings". Advances in Computational Penetration Mechanics Workshop, U.S. Army Engineer Research & Development Center, Vicksburg (MS), Jan. 2006.