

# CHANGHONG KE

Professor

Department of Mechanical Engineering

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## RESEARCH INTERESTS

Experimental nanomechanics, nanocomposites, nanoscale adhesion and interfaces, bio-inspired hybrid nanomaterials and NEMS

## EDUCATION

**Ph.D. Mechanical Engineering**, Northwestern University 2006

Dissertation Advisor: Horacio D. Espinosa

**M.S. Mechanical Engineering**, Beijing Institute of Technology 2000

**B.S. Mechanical Engineering**, Beijing Institute of Technology 1997

## PROFESSIONAL EXPERIENCE

09/18 – present: Professor, Department of Mechanical Engineering, State University of New York at Binghamton

12/15 – present: Affiliated Faculty, Materials Science and Engineering Program, State University of New York at Binghamton

09/13 – 08/18: Associate Professor, Department of Mechanical Engineering, State University of New York at Binghamton

09/13 – 11/13: Visiting Professor, Department of Civil, Environmental, and Mechanical Engineering, University of Trento (Italy)

09/07 – 08/13: Assistant Professor, Department of Mechanical Engineering, State University of New York at Binghamton

04/06 – 08/07: Postdoctoral Research Associate, Department of Mechanical Engineering and Materials Science, Center of Biologically Inspired Materials and Material Systems, Duke University (Supervisor: Piotr E. Marszalek)

## AWARDS AND HONORS

ICTAM Award, US National Committee on Theoretical and Applied Mechanics, 2012

AFOSR Young Investigator Program Award, 2011

## TEACHING/COURSE OFFERING

- ME 211 “Introduction to Solid Mechanics (Mechanics of Materials)” (sophomore)
- ME 412 “Structural Mechanics” (junior/senior)
- ME 511 “Elasticity” (graduate)
- ME 514 “Plasticity” (graduate)
- ME 518 “Advanced Mechanics of Materials” (senior/graduate)
- ME 570 “Introduction to Nanotechnology” (senior/graduate)
- ME 586 “Reliability-based Mechanical Design” (graduate)

## PUBLICATIONS

### Published Refereed Journal Articles

(Google scholar link: <https://scholar.google.com/citations?user=r8ZhcAkAAAAJ&hl=en>)

1. Ohood Q Alsmairat, Feilin Gou, Christopher M Dmuchowski<sup>1</sup>, Paul R Chiarot, Cheol Park, Ron N Miles, **Changhong Ke**, “Quantifying the Interfacial Load Transfer in Electrospun Carbon Nanotube Polymer Nanocomposite Microfibers by Using in situ Raman Micromechanical Characterization Techniques,” *Journal of Physics D: Applied Physics*, Vol. 53, pp. 365302, 2020.
2. Huimin Zhou, Christopher Dmuchowski, **Changhong Ke**, Jia Deng, “External-Energy-Assisted Nanomachining with Low-stiffness Atomic Force Microscopy Probes,” *Manufacturing Letters*, Vol. 23, pp. 1-4, 2020.
3. Wenyang Qu, Soumendu Bagchi, Xiaoming Chen, Huck Beng Chew, and **Changhong Ke**, “Bending and Interlayer Shear Moduli of Few-layer Boron Nitride Nanosheets,” *Journal of Physics D: Applied Physics*, Vol. 52, pp. 465301, 2019.
4. Feilin Gou and **Changhong Ke**, “Theoretical Predictions of the Interfacial Stress Transfer in Nanotube-reinforced Polymer Nanocomposites by Using a Strain-hardening Shear-lag Model,” *Multiscale Science and Engineering*, Vol. 1, pp. 236-246, 2019.
5. Wenyang Qu, Feilin Gou and **Changhong Ke**, “Thermal-induced Irreversible Straining of Ultrathin Boron Nitride Nanosheets,” *Applied Physics Letters*, Vol.114, pp. 051901, 2019.
6. Chenglin Yi, Liuyang Zhang, Xiaoming Chen, Xianqiao Wang, and **Changhong Ke**, “Nanomechanical Unfolding of Self-folded Graphene on Flat Substrate,” *Experimental Mechanics*, Vol. 59, pp. 381-386, 2019.
7. Stefano Signetti, Xiaoming Chen, **Changhong Ke**, and Nicola M. Pugno, “A Numerical-experimental Approach Towards Picomechanics and Picotribology: the Case Study of Defective Carbon Nanotubes Bundles,” *Journal of Physics D: Applied Physics*, Vol. 52, pp.255305, 2019.
8. Jie Li, **Changhong Ke**, Xing Tong, Yandong Jia, Shiwei Wu, Juefei Jia, Jun Yi, Gang Wang “Impact of free volume on shear band multiplication and bending plasticity,” *Materials Science & Engineering A*, Vol. 747, pp. 136-143, 2019.
9. Chenglin Yi, Soumendu Bagchi, Feilin Gou, Christopher M Dmuchowski, Cheol Park, Catharine C. Fay, Huck Beng Chew, and **Changhong Ke**, “Direct Nanomechanical Measurements of Boron Nitride Nanotube - Ceramic Interfaces,” *Nanotechnology*, Vol. 30, pp. 025706, 2019.
10. Soumendu Bagchi, **Changhong Ke**, and Huck Beng Chew, “Oxidation effects on the shear strength of graphene on aluminum and titanium surfaces,” *Physical Review B*, Vol. 98, pp. 174106, 2018.

11. Chenglin Yi, Soumendu Bagchi, Christopher M Dmuchowski, Feilin Gou, Xiaoming Chen, Cheol Park, Huck Beng Chew, and **Changhong Ke**, "Direct Nanomechanical Characterization of Carbon Nanotube - Titanium Interfaces," *Carbon*, Vol. 132, pp. 548-555, 2018
12. Chenglin Yi, Xiaoming Chen, Feilin Gou, Christopher M Dmuchowski, Anju Sharma, Cheol Park, and **Changhong Ke**, "Direct Measurements of the Mechanical Strength of Carbon Nanotube - Aluminum Interfaces," *Carbon*, Vol. 125, pp. 93-102 2017.
13. Xiaoming Chen, Christopher M Dmuchowski, Cheol Park, Catharine C. Fay and **Changhong Ke**, "Quantitative Characterization of Structural and Mechanical Properties of Boron Nitride Nanotubes in High Temperature Environments," *Scientific Reports*, Vol. 6, pp.11388, 2017.
14. Xiaoming Chen, and **Changhong Ke**, "Load Transfer and Energy Absorption in Transversely Compressed Multi-walled Carbon Nanotubes." *Coupled Mechanics Systems*, Vol. 6, pp. 273-286, 2017.
15. Vesselin Yamakov, Cheol Park, Jin Ho Kang, Xiaoming Chen, **Changhong Ke**, Catharine Fay, "Piezoelectric and Elastic Properties of Multiwall Boron Nitride Nanotubes and Their Fibers: a Molecular Dynamics Study," *Computational Materials Science*, Vol. 135, pp. 29-42, 2017.
16. Wenyang Qu, Xiaoming Chen, **Changhong Ke**, "Temperature-dependent Frictional Properties of Ultra-thin Boron Nitride Nanosheets," *Applied Physics Letters*, Vol. 110, pp.143110, 2017.
17. Chenglin Yi, Xiaoming Chen, Liuyang Zhang, Xianqiao Wang, and **Changhong Ke**, "Nanomechanical Z-shape Folding of Graphene on Flat Substrate," *Extreme Mechanics Letters*, Vol. 9, pp.84-90, 2016.
18. Xiaoming Chen, Meng Zheng, Qing Wei, Stefano Signetti, Nicola M. Pugno and **Changhong Ke**, "Mechanical Deformation of Nanotubes in Peeling Contact with Flat Substrate: an *in situ* Electron Microscopy Nanomechanical Study," *Journal of Applied Physics*, Vol. 119, pp. 154305, 2016.
19. Xiaoming Chen, Liuyang Zhang, Cheol Park, Catharine C. Fay, Xianqiao Wang and **Changhong Ke**, "Mechanical Strength of Boron Nitride Nanotube-Polymer Interfaces," *Applied Physics Letters*, Vol. 107, 253105, 2015. (*Editor's pick, on the most read list*).
20. Xiaoming Chen, Chenglin Yi, and **Changhong Ke**, "Bending Stiffness and Interlayer Shear Modulus of Few-layer Graphene," *Applied Physics Letters*, Vol. 106, Art No 101907, 2015.
21. Xiaoming Chen, Liuyang Zhang, Meng Zheng, Cheol Park, Xianqiao Wang and **Changhong Ke**, "Quantitative Nanomechanical Characterization of the van der Waals Interfaces between Carbon Nanotubes and Epoxy," *Carbon*, Vol. 82, pp. 214-228, 2015.
22. Lu Yuan, Xiaoming Chen, Suraj Maganty, Junghyun Cho, **Changhong Ke**, Guangwen Zhou, "Enhancing the Cu<sub>2</sub>O/Cu interfacial adhesion by sandblasting copper surfaces," *Applied Surface Science*, Vol. 357, pp. 2160-2168, 2015.
23. Xiaoming Chen, Liuyang Zhang, Yadong Zhao, Xianqiao Wang, and **Changhong Ke**, "Graphene Folding on Flat Substrates," *Journal of Applied Physics*, Vol. 116, pp. 164301, 2014.
24. Yadong Zhao, Xiaoming Chen, Cheol Park, Catharine C. Fay, Stanislaw Stupkiewicz and **Changhong Ke**, "Mechanical Deformations of Boron Nitride Nanotubes in Crossed Junctions," *Journal of Applied Physics*, Vol. 115, pp.164305, 2014.
25. Meng Zheng, Xiaoming Chen, Cheol Park, Catharine C. Fay, Nicola M. Pugno, and **Changhong Ke**, "Nanomechanical Cutting of Boron Nitride Nanotubes by Atomic Force Microscopy," *Nanotechnology*, Vol. 24, pp.505719, 2013
26. Xiaoming Chen, Meng Zheng, Cheol Park, and **Changhong Ke**, "Collision and Dynamic Frictional Properties of Boron Nitride Nanotubes," *Applied Physics Letters*, Vol. 102, Art No 121912, 2013.

27. Xiaoming Chen, Meng Zheng, Cheol Park, and **Changhong Ke**, “Direct Measurements of the Mechanical Strength of Carbon Nanotube-Poly(methyl methacrylate) Interfaces,” *Small*, Vol. 9, pp. 3345–3351, 2013.
28. Shanshan Li, Quan Yuan, Bashir I. Morshed, **Changhong Ke**, Jie Wu and Hongyuan Jiang, “Dielectrophoretic Responses of DNA and Fluorophore in Physiological Solution by Impedimetric Characterization,” *Biosensors and Bioelectronics*, Vol.41, pp.649–655, 2013.
29. Meng Zheng, Lianfeng Zou, Howard Wang, Cheol Park, and **Changhong Ke**, “Quantifying the Transverse Deformability of Double-walled Carbon and Boron Nitride Nanotubes using an Ultrathin Nanomembrane Covering Scheme,” *Journal of Applied Physics*, Vol. 112, Art No 104318, 2012.
30. Meng Zheng, Lianfeng Zou, Howard Wang, Cheol Park, and **Changhong Ke**, “Engineering Radial Deformations in Single-walled Carbon and Boron-Nitride Nanotubes,” *ACS Nano*, Vol. 6, pp. 1814–1822, 2012.
31. Meng Zheng, **Changhong Ke**, Intae Bae, Cheol Park, Michael W. Smith, Kelvin Jordan, “Radial Elasticity of Multi-walled Boron Nitride Nanotubes,” *Nanotechnology*, Vol. 23, Art No 095703, 2012.
32. Meng Zheng, Xiaoming Chen, Intae Bae, **Changhong Ke**, Park, Michael W. Smith, Kelvin Jordan, “Radial Mechanical Properties of Single-walled Boron Nitride Nanotubes,” *Small*, Vol. 8, pp. 116-122, 2012.
33. Meng Zheng and **Changhong Ke**, “Mechanical Deformation of Carbon Nanotube Nano-Rings on Flat Substrate,” *Journal of Applied Physics*, Vol. 109, 074304, 2011. [*This article is selected to be included in the Virtual Journal of Nanoscale Science & Technology, 2011 Vol.23, No.15*]
34. Owen Loh, Xiaoding Wei, **Changhong Ke**, John Sullivan, Horacio D. Espinosa, “Robust carbon nanotube-based nanoelectromechanical devices: Understanding and eliminating prevalent failure modes using alternative electrode materials,” *Small*, Vol.7, pp.79-86, 2011.
35. Qing Wei, Meng Zheng, and **Changhong Ke**, “Post-buckling Deformation of Single-walled Carbon Nanotubes,” *Nanoscience and Nanotechnology Letters*, Vol. 2, pp.308-314, 2010.
36. Meng Zheng and Changhong Ke, “Elastic Deformation of Carbon Nanotube Nano-Rings,” *Small*, Vol. 6, pp.1647–1655, 2010.
37. **Changhong Ke**, Meng Zheng, Intae Bae, Guangwen Zhou, “Adhesion-Driven Buckling of Single-walled Carbon Nanotube Bundles,” *Journal of Applied Physics*, Vol. 107, 104305, 2010. [*This article is selected to be included in the Virtual Journal of Nanoscale Science & Technology, 2010 Vol.21, No.22.*]
38. **Changhong Ke**, Meng Zheng, Guangwen Zhou, Wei Cui, Nicola Pugno, Ron N. Miles, “Mechanical Peeling of Freestanding Single-walled Carbon Nanotube Bundles,” *Small*, Vol. 6, pp.438-445, 2010.
39. Meng Zheng, Kholo Eom, and **Changhong Ke**, “Calculations of the Resonant Response of Carbon Nanotube to Binding of DNA,” *Journal of Physics D- Applied Physics*, Vol. 42, Art No 145408, 2009.
40. **Changhong Ke**, “Resonant Pull-in of a Double-sided Driven Nanotube-Based Electromechanical Resonator,” *Journal of Applied Physics*, Vol.15, 024301, 2009. [*This article is selected to be included in the Virtual Journal of Nanoscale Science & Technology, 2009 Vol.19, No.5.*]
41. **Changhong Ke**, Anna Lokszejn, Yong Jiang, Minkyu Kim, Michael Humeniuk, Mahir Rabbi, Piotr E. Marszalek “Detecting Solvent Driven Transitions of poly(A) to Double-Stranded Conformations by Atomic Force Microscopy,” *Biophysical Journal*, Vol. 96, pp. 2918-2925,

- 2009.
42. Yong Jiang, Mahir Rabbi, Minkyu Kim, **Changhong Ke**, Whasil Lee, Robert L. Clark, Piotr. A. Mieczkowski, and Piotr E. Marszalek, "UVA Generate Pyrimidine Dimers in DNA directly," *Biophysical Journal*, Vol. 96, pp1151-1158, 2009.
  43. Monica Rivera, Whasil Lee, **Changhong Ke**, Piotr. E Marszalek, Daniel G Cole, Robert. L. Clark, "Minimizing Pulling Geometry Errors in Atomic Force Microscope Single Molecule Force Spectroscopy," *Biophysical Journal*, Vol.95, pp.3991-3998, 2008.
  44. Changhong Ke, Yong Jiang, Piotr A. Mieczkowski, Garrett G. Muramoto, John P.Chute, Piotr E. Marszalek, "Nanoscale Detection of Radiation Damage to DNA by Atomic Force Microscopy," *Small*, Vol. 4, pp. 288-294, 2008.
  45. **Changhong Ke**, M. Humeniuk, Hanna S-Gracz, Piotr E. Marszalek, "Direct Measurements of Base Stacking Interactions in DNA by Single-Molecule Atomic Force Spectroscopy," *Physical Review Letters*, Vol. 99, pp. 018302, 2007. [*This paper was selected as one of the 36 most important work worldwide in Physics in 2007 by APS News.*]
  46. Yong Jiang, **Changhong Ke**, Piotr A. Mieczkowski, and Piotr E. Marszalek, "Detecting UV Damage in Single DNA Molecules by Atomic Force Microscopy," *Biophysical Journal*, Vol.93, pp.175-1767, 2007.
  47. **Changhong Ke**, Yong Jiang, Monica Rivera, Robert L. Clark, Piotr E. Marszalek, "Pulling Geometry Induced Errors in Single Molecule Force Spectroscopy Measurements," *Biophysical Journal-Biophysical Letters*, Vol. 92, pp.L76-L78, 2007.
  48. Yong Zhu, **Changhong Ke** and Horacio D. Espinosa, "Experimental Techniques for the Mechanical Characterization of One-Dimensional Nanostructures," *Experimental mechanics*, Vol. 47, pp.7-24, 2007.
  49. **Changhong Ke** and Horacio D. Espinosa, "In-situ Electron Microscopy Electro-Mechanical Characterization of a NEMS Bistable Device," *Small*, Vol. 2, pp. 1484-1489, 2006.
  50. Keun-Ho. Kim, Nicolas Moldovan, **Changhong Ke**, Horacio D. Espinosa, X. Xiao, J. Carlisle, O. Auciello, "Novel Ultrananocrystalline Diamond Probes for High Resolution Low-Wear Nanolithographic Techniques," *Small*, Vol. 1, pp. 866-874, 2005.
  51. **Changhong Ke**, Nicola Pugno, Bei Peng, and Horacio D. Espinosa, "Experiments and Modeling of Carbon Nanotube Based NEMS devices," *Journal of the Mechanics and Physics of Solids*, Vol. 53, pp.1314-1333, 2005.
  52. Nicola Pugno, **Changhong Ke**, and Horacio D. Espinosa, "Analysis of Doubly-Clamped Nanotube Devices in Finite Deformation Regime," *Journal of Applied Mechanics*, Vol.72, pp.445-449, 2005.
  53. **Changhong Ke**, Horacio D. Espinosa and Nicola Pugno, "Numerical Analysis of Nanotube Based NEMS Devices. Part II: Role of Finite Kinematics, Stretching and Charge Concentrations," *Journal of Applied Mechanics*, Vol. 72, pp.726-731, 2005.
  54. **Changhong Ke** and Horacio D. Espinosa, "Numerical Analysis of Nanotube Based NEMS Devices. Part I: Electrostatic Charge Distribution on Multiwalled Nanotubes," *Journal of Applied Mechanics*, Vol. 72, pp.721-725, 2005.
  55. **Changhong Ke** and Horacio D. Espinosa, "Feedback Controlled Nanocantilever Device," *Applied Physics Letters*, Vol. 85, pp.681-683, 2004. [*This article is selected to be included in the Virtual Journal of Nanoscale Science & Technology, 2004 Vol.10, No. 6.*]

### **Book Chapters**

1. Xiaoming Chen and **Changhong Ke**, "Structural and physical properties of boron nitride

- nanotubes and their applications in nanocomposites,” chapter in book “*Boron Nitride Nanotubes in Nanomedicine*,” Editors Dr. Gianni Ciofani and Dr. Virgilio Mattoli, Elsevier, 2016.
2. **Changhong Ke** and Xiaoming Chen, “Interfacial Interactions in 1D and 2D Nanostructure-based Material Systems,” chapter in book “*Anisotropic Nanomaterials: Preparation, Properties, and Applications*,” Editor Dr. Quan Li, Springer, Heidelberg, 2015, ISBN 978-3-319-18292-6.
  3. **Changhong Ke**, “Electromechanical Properties and Applications of Carbon Nanotube Nanocantilevers,” chapter in book “*Nanocantilever Beams: Modeling, Fabrication and Applications*,” Editors Dr. Zaghoul and Dr. Voiculescu, Pan Stanford Publishing, 2016, ISBN 978-9814613231.
  4. **Changhong Ke** and Qing Wei, “Advances in Nano-resonators: towards Ultimate Mass, Force and Molecule Sensing,” chapter in book “*Simulations in Nanobiotechnology*,” Editor Dr. Kilho Eom, Elsevier, 2011.
  5. **Changhong Ke** and Meng Zheng, “Nanoscale Adhesion Interactions in 1D and 2D Nanostructure-based Material Systems,” chapter in book “*Simulations in Nanobiotechnology*,” Editor Dr. Kilho Eom, Elsevier, 2011.
  6. **Changhong Ke** and Horacio D. Espinosa, “Nanoelectromechanical Systems (NEMS) and Modeling,” chapter 121 in the *Handbook of Theoretical and Computational Nanotechnology*, American Scientific Publishers, 2006.
  7. Horacio D. Espinosa and **Changhong Ke**, “Nanoelectromechanical Systems – Experiments and Modeling,” *Applied Scanning Probe Methods*, Vol. 5-7 Edited by B. Bhushan, H. Fuchs, and S. Kawata, Springer-Verlag, Heidelberg, 2006.
  8. Horacio D. Espinosa, **Changhong Ke** and Nicola Pugno, “Nanoelectromechanical Systems (NEMS): Device and Modeling,” *Encyclopedia of Materials: Science and Technology*, Editor-in-chief Dr. Patrick Veysseyre, Elsevier, 2005.

### **Patents and Disclosures**

1. Guangwen Zhou, Lu Yuan, Xiaoming Chen and **Changhong Ke**, “Enhancing the Cu<sub>2</sub>O/Cu interfacial adhesion by sandblasting copper surfaces,” patent disclosure ID: RB454, 2014.
2. Horacio D. Espinosa and **Changhong Ke**, “Nanoelectromechanical Bistable Cantilever Device,” US patent 7,612,424.

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