

Chun-il Kim, Ph.D. P.Eng.

Associate Professor

Department of Mechanical Engineering

University of Alberta, Edmonton, T6G1H9, Alberta, Canada

Assistant Professor (Status-only)

Department of Mechanical & Industrial Engineering, University of Toronto, Canada

Email: cikim@ualberta.ca

Citizenship Status in Canada: **Canadian Citizen** (Country of origin: South Korea)

Professional Interests

Polymeric Composites, Planar & Supported Lipid Bilayer Systems, Micro/Nano-fibrillated Cellulose Composite Materials, Composite Fabrics, Continuum Mechanics, Non-linear Mechanics, Soft Robotics, Plate and Shell Theory, Engineering Rheology (Viscoelasticity), Finite Element Analysis, Statistical Mechanics and Optimization

Education

NSERC Post-doctoral Fellow in Mechanical Engineering 2012 – 2014

Department of Mechanical Engineering, University of California – Berkeley, U.S.A

Supervisor: Prof. David J. Steigmann

Area of Research: Fiber-reinforced Hyperelastic Composite, Lipid Bilayer Membrane, Continuum Mechanics, Finite Element Analysis, Plate and Shell Structures

Ph.D. in Mechanical Engineering 2007 – 2012

Department of Mechanical Engineering, University of Alberta, Canada

Supervisor: Prof. Peter Schiavone, Prof. Chong-Qing Ru

Thesis: “Contribution of Surface Elasticity in Linear Elastic Fracture Mechanics”

Area of Research: Micro and Nano Structure Design and Analysis, Non-linear mechanics, Nano Mechanics, Fracture Mechanics

M.Sc. in Mechanical Engineering 2005 – 2007

Department of Mechanical Engineering, University of Alberta, Canada

Supervisor: Prof. Peter Schiavone

Thesis: “An Elastic Inhomogeneity with Perfectly Bonded Interface Subjected to a General Class of Nonuniform Remote Loading”

Area of Research: Particulate Reinforced Composite, Solids Mechanics, Plate and Shell Structure Analysis

B.Sc. in Mechanical Engineering 1997 – 2004

Department of Mechanical Engineering, Donga University, South Korea – cum laud

Appointment

Associate Professor

July 2014 – Present

Department of Mechanical Engineering, University of Alberta, Canada

Assistant Professor (Status – Only) Feb 2020 – Present
Department of Mechanical & Industrial Engineering, University of Toronto, Canada

Sessional Lecturer 2013 Summer – Fall
Department of Mechanical Engineering, University of California – Berkeley, U.S.A

Academic Honors and awards

NSERC postdoctoral Fellowships	2012 – 2014
Andrew Stewart Memorial Graduate Prize	2011
Dissertation Fellowship	2011
Korean Canadian Science Scholarship Foundation (KCSSF) scholarship	2010
First Place Award in Association of Korean Canadian Scientists and Engineers (AKCSE) Research competition	2010
Profiling Alberta's Graduate Students Award	2010
Alberta Ingenuity Graduate Student Scholarship in Nanotechnology	2009 – 2011
Provost Doctoral Entrance Award	2007 – 2009
Mary Louise Imrie Graduate Student Award	2007
Brain Korea 21 (BK 21) Scholarship	2002 – 2003
Third Place Award in Undergraduate Team Project Competition	2003

Affiliation

Member of the **Association of Professional Engineers and Geoscientist of Alberta (APEGA)**

Member of **Golden Key International Honor Society**

Board Member & Director (operation) & committee chair (outreach program) of the **Association of Korean Canadian Scientists and Engineers (AKCSE)**

Former Squadron leader (a sergeant/corporal: an honorable discharge): **South Korea Army, The 5th Army Corps Artillery (H.Q.)**

Professional Service

Associate Editor: Journal of Mechanical Science and Technology-Springer

Editorial Board Member: Coupled Systems Mechanics

Editorial Board Member: Multiscale Science Engineering-Springer

Reviewer Editor: Frontiers in Materials-Smart Materials

Reviewer: Journal of Elasticity, Mathematical Reviews, Mathematics and Mechanics of Solids

International Technical committee: International Conference on Advanced Materials and Applications (AMA 2019), April 10-13, 2019, Ningbo, China

International Technical committee: 2019 International Conference on Advances in Materials, Mechanical and Manufacturing (AMMM 2019), Beihang University, Beijing, China

Program committee: Confluence (International Conference on Cloud Computing, Data Science & Engineering) (2016, 2017, 2018, 2019)

International technical committee: International Symposium on Material Science and Technology (2016, 2017, 2018)

International Advisory committee: International Conference on Soft Computing Applications to Power Systems and Power Electronics" (ICPSPE-2017)

Supervision of Graduate students

Suparbha Islam (2019 ~ Current): Ph.D. in progress

Eyup Demir (2017~Current): Ph.D. in progress (Candidacy exam passed)

Mahdi Zeidi (2019 ~ Current): Ph.D. in progress (Candidacy exam passed)

Abiy Wubneh (2017 ~ Current): Ph.D. in progress (Candidacy exam passed)

Wenhao Yao (2018 ~ Current): Ph.D. in progress (Candidacy exam passed, CSC scholarship student)

Hafijur Rahman (2020~ Current): M.Sc.

Marjan Darabi (2020~ Current): M.Sc.

Tsegay Belay (2012~2016): Ph.D. (graduated)

Mahdi Zeidi (2017~2019): M.Sc. (graduated)

Zhe Liu (2018~2020): M.Sc (graduated) (CSC scholarship student)

Ehsan boloury (2017~2020): M.Sc. (graduated)

Research Funding History

NSERC Discovery Grant

2015 – 2022

Mechanics of surfaces: Continuum-based modeling and analysis for biomembranes and 2D fiber materials: **Total Funding-189,000** (27,000 per annum)

NSERC Collaborative Research and Development Grant

2017 – 2020

Reinforcing effect of Cellulose Nanocrystals on Polyamide-6 polymeric nano-composite films and electrospun composite nano-fiber yarns (Co. P.I.): **Total Cash: 200,000, Total In-Kind: 64,000**

NRC-CNRC Collaborative R&D Initiative

2021 – 2028

Printed electronics (PE)-based sensors for fall detection and prediction: **Total suggested funding-245,000** (35,000 per annum). **Remark:** the application pushed forward to the second round.

Startup Grant

2017 – 2020

Formulation, development and analysis of an original theory describing the general behavior of biomembranes: **Total funding – 100,000** (25,000 per annum)

Refereed Journal Papers

1. W. Yao, **C.I. Kim**. "An analysis of lipid membrane morphology in the presence of coordinate dependent non-uniformity", *Math. Mech. Solids* (2020), doi.org/10.1177/1081286520939162.
2. R. Abraham, F.Khan, Syed A. Bukhari, Q. Liu, T. Thundat, H. J. Chung *, **C.I. Kim *** "Effect of Surface and Interfacial Tension on the Resonance Frequency of Microfluidic Channel Cantilever", *Sensors*, 20, 6459; doi:10.3390/s20226459 (2020)
3. Ilaria Rubino, Euna Oh, Sumin Han, Sana Kaleem, Alex Hornig, Su-Hwa Lee, Hae-Ji Kang, Dong-Hun Lee, Ki-Back Chu, Surjith Kumaran, Sarah Armstrong, Romani Lalani, Shivanjali Choudhry, **C.I. Kim**, Fu-Shi Quan, Byeonghwa Jeon & Hyo-Jick Choi. "Salt coatings functionalize inert membranes into high-performing filters against infectious respiratory diseases", *Scientific Reports – Nature* 10(1), (2020)

4. S. Islam, D. Zhalmuratova, H.J. Chung, **C.I. Kim***, "A model for hyperelastic materials reinforced with fibers resistance to extension and flexure", *Int. J. Solids and Structure*, 193-194, 418-433 (2020)
5. **C.I. Kim**, S. Islam "Mechanics of third-gradient continua reinforced with fibers resistance to flexure in finite plane elastostatics", *Cont. Mech. Thermodyn.* (DOI: 10.1007/s00161-020-00867-3) (2020)
6. Z. Liu, **C.I. Kim** "Deformation analysis of lipid membranes subjected to general forms of intra-membrane viscous flow and interactions with an elliptical-cross-section substrate", *Scientific Reports – Nature*, 10 (1), 1-19 (2020)
7. M. Zeidi, **C.I. Kim**, "The effects of intra-membrane viscosity on lipid membrane morphology: complete analytical solution", *Scientific Reports – Nature*, 8 (1), 12845 (2020)
8. **C.I. Kim**, M. Zeidi, "Gradient elasticity theory for fiber composites with fibers resistant to extension and flexure", *International Journal of Engineering Science*, 131, 80-99 (2019)
9. S. E. Seyed Bolouri, **C.I. Kim***, S. Yang "Linear theory for the mechanics of third-gradient continua reinforced with fibers resistance to flexure", *Mathematics and Mechanics of Solids*, (2019) 1081286519893408
10. **C.I. Kim**, "Strain-Gradient Elasticity Theory for the Mechanics of Fiber Composites Subjected to Finite Plane Deformations: Comprehensive Analysis", *Multiscale Science and Engineering*, 1 (2), 150-160 (New Journal in Springer Nature) (2019)
11. **C.I. Kim**, Zhe Liu, "Mechanics of Lipid Membranes under the Influence of Intramembrane Viscosity", to appear in *Mathematical Problems in Engineering*, doi.org/10.1155/2019/3412129 (2019)
12. D. Zhalmuratova, T-G. La, Thanh-Giang, K. Yu, A. Szojka, S. Andrews, A. B. Adesida, **C.I. Kim**, D. Nobes, D. Freed, H. J. Chung, "Mimicking 'J-shaped' and anisotropic stress-strain behavior of human and porcine aorta by fabric-reinforced elastomer composites" *ACS Appl. Mater. Interfaces* 2019113633323-33335 (2019)
13. W.K. Jo, **C.I. Kim**, "System Analysis of a Gas Generator Cycle Rocket Engine", *Int J. Aerospace system Engineering*. 6(2), 11-16, (2019)
14. M. Zeidi, **C.I. Kim** "Finite plane deformations of elastic solids reinforced with fibers resistant to flexure: Complete solution" *Arch. Appl. Mech.* 88 (5), 819-835 (2018)
15. M. Zeidi, **C.I. Kim** "Mechanics of an elastic solids reinforced with bidirectional fiber in finite plane elastostatics: Complete analysis" *Cont. Mech. Thermodynamics* 30 (3), 573-592 (2018)
16. W.K. Jo, **C.I. Kim**, "Comparison of Effectiveness for Performance Tuning of Liquid Rocket Engine", *Int J. Aerospace system Engineering*. 15 (2), 16-22, (2018).
17. M. Zeidi, **C.I. Kim** "Notes on the Superposed Incremental Deformations in the Mechanics of Lipid Membranes" *Math. Mech. Solids*. doi: 1081286517734608 (2017)
18. M. Zeidi, **C.I. Kim** "Mechanics of fiber composites with fibers resistant to extension and flexure" *Math. Mech. Solids*, doi: 10.1177/1081286517728543 (2017)
19. **C.I. Kim**, "Superposed Incremental Deformations of an Elastic Solid Reinforced with Fibers Resistant to Extension and Flexure", *Advances in Materials Science and Engineering*, doi.org/10.1155/2018/6501985 (2018)
20. **C.I. Kim**, "A Discussion on the Mechanics of Lipid Membranes: Lagrange multipliers and a singular substrate" *Zeitschrift für angewandte Mathematik und Physik (ZAMP)*. 68 (4), 84, (2017)
21. T. Belay, **C.I. Kim***, P. Schiavone "Mechanics of lipid bilayer subjected to thickness distension and membrane budding" *Math. Mech. Solids*, 23 (1) 67-84 (2016)
22. T. Belay, **C.I. Kim***, P. Schiavone "Budding formation of lipid membranes in response to the surface diffusion of transmembrane proteins and line tension." *Math. Mech. Solids*, 22(11), 2091-2107. (2016)
23. **C.I. Kim** "Mechanics of lipid membranes subjected to boundary excitations and an elliptic substrate interactions" *Coupled Systems Mechanics*, doi: 10.12989/mmm.2016.1.3.245 (2016)

24. T. Bely, **C.I. Kim***, P. Schiavone “Analytical Solution of lipid membrane morphology subjected to Boundary forces on the edges of rectangular membranes”, *Continuum Mechanics and Thermodynamics*. 28, 305–315 (2016)
25. T. Bely, **C.I. Kim***, P. Schiavone “Interaction induced morphological transitions of lipid membranes in contact with an elliptical cross section of a rigid substrate”. *Journal of applied mechanics (ASME)*. 83(1): 12 pages (2015)
26. **C.I. Kim**, “On the mechanics of lipid membranes: Constitutive modeling and analysis”. *Computational Structural Engineering*. 28(2): 36-44 (2015)
27. **C.I. Kim**, D.J. Steigmann, “Distension-induced Gradient Capillarity in Lipid Membranes”, *Continuum Mechanics and Thermodynamics*, 27, 609-621(2014)
28. **C.I. Kim**, P. Schiavone, C-Q. Ru, “Effects of Boundary Reinforcement on Local Singular Fields in Linear Elastic Materials.” *Archives of Mechanics*. 65(4): 289-300 (2013)
29. **C.I. Kim**, P. Schiavone, C-Q. Ru, “A Clarification of the Role of Crack-tip Conditions in Linear Elasticity with Surface Effects.” *Math. Mech. Solids*. 18(1): 1-8 (2013)
30. **C.I. Kim**, C-Q. Ru, L. J. Sudak, P. Schiavone, “Analysis of Local Singular Fields Near the Corner of a Quarter-Plane with Mixed Boundary Conditions in Finite Plane Elastostatics.” *Invited Paper – Special Issue on Int. J. Nonlinear Mech*. 47(2) 151-155 (2012)
31. **C.I. Kim**, P. Schiavone, C-Q. Ru, “Effect of Surface Elasticity on an Interface Crack in Plane Deformations.” *Proc. Roy. Soc. London A*. 467: 3530–3549 (2011)
32. **C.I. Kim**, “An Analysis of an Elastic Solid Incorporating a Crack Under the Influences of Surface Effects in Plane & Anti-plane Deformations.” *Invited Paper – Special Issue on Interaction and Multiscale Mechanics*. 4(2): 123-137. (2011)
33. **C.I. Kim**, P. Schiavone, C-Q. Ru, “The Effect of Surface Elasticity on a Mode-III Interface Crack.” *Arch. Mech*. 63(3): 267–286 (2011)
34. **C.I. Kim**, P. Schiavone, C-Q. Ru, “Analysis of Plane-Strain Crack Problems (Mode I and Mode II) in the Presence of Surface Elasticity.” *J. Elasticity*. 104(1): 397–420 (2011)
35. **C.I. Kim**, P. Schiavone, C-Q. Ru, “The Effects of Surface Elasticity on an Elastic Solid with Mode-III Crack: Complete Solution.” *ASME J. Appl. Mech*. 77: 021011-1-021011-7 (2010)
36. **C.I. Kim**, P. Schiavone, C-Q. Ru, “Analysis of a Mode-III Crack in the Presence of Surface Elasticity and a Prescribed Non-Uniform Surface Traction.” *Z. angew. Math. Phys*. 61(3): 555–564 (2010)
37. **C.I. Kim**, P. Schiavone, “Finite Plane Deformations of a Three-phase Circular Inhomogeneity-Matrix System.” *J. Math. Anal. Appl*. 353: 161–171 (2009)
38. **C.I. Kim**, P. Schiavone, “An Elliptic Inhomogeneity Subjected to a General Class of Nonuniform Remote Loadings in Finite Elasticity.” *Math. Mech. Solids*. 14(4): 421-442 (2009)
39. **C.I. Kim**, P. Schiavone, “Eshelby's Conjecture in Finite Plane Elastostatics.” *Q. Jl. Mech. Appl. Math*. 61(1): 63-73 (2008)
40. **C.I. Kim**, P. Schiavone, “Designing an Inhomogeneity with Uniform Interior Stress in Finite Plane Elastostatics.” *Acta. Mech*. 197(3): 285-299 (2008)
41. **C.I. Kim**, P. Schiavone, “A Circular Inhomogeneity Subjected to Nonuniform Remote Loading in Finite Plane Elastostatics.” *Int. J. Nonlinear Mech*. 42(8): 989-999 (2007)

Peer-reviewed conference proceedings

1. **C.I. Kim**, S. Islam, S. E. S. Bolouri, Z. Liu, “Mechanics of higher gradient continua in the application of microstructured materials”, *Korea Multi-scale Mechanics 2019 Symposium (KMSM 2019)*, Seoul, Korea, (2019)

2. D. Eyup, **C.I. Kim**, A. Cagri, "Production and Characterization of CNC reinforced polyamide-6 nano composites films", 11th Canadian International Conference on Composites CANCOM 2019, Kelowna, BC Canada, (2019)
3. **C.I. Kim**, M. Zeidi, "Morphological transitions of lipid membranes subject to intra-membrane viscous flow and substrate interactions", Canada-Korea Conference and Technology (CKC 2018), Vancouver, BC, Canada, (2018)
4. **C.I. Kim**, M. Zeidi, "Mechanics of bidirectional fiber composites with fibers resistant to extension and flexure. The 2018 World Congress of Advances in Civil, Environmental & materials Research, (ACEM18), Songdo, Incheon, Korea, 28-31, (2018)
5. **C.I. Kim**, M. Zeidi, "Strain-gradient theory of an Elastic solids reinforced with bidirectional fiber in finite plane elastostatics", Canada-Korea Conference and Technology (CKC 2018), Vancouver, BC, Canada, (2018)
6. **C.I. Kim**, E. S. Bolouri, Z. Liu, "Theory of higher order continua in the application of micro-structured materials", Korea Multi-scale Mechanics 2018 Symposium (KMSM 2018), Jeonju, Korea, (2018).
7. **C.I. Kim**, T. Belay and Peter Schiavone, "Mechanics of lipid membranes: Superposed incremental deformations, vesicle formations, thickness distension", The 2017 World Congress on Advances in Civil, Environmental & Materials Research (ACEM 17), Ilsan, Korea (2017)
8. **C.I. Kim**, "On the Role of Surface Effects in the Linear Elastic Fracture Mechanics". SIAM 2017, Pittsburgh, USA (2017)
9. **C.I. Kim**, T. Belay and P. Schiavone, "On the mechanics of lipid membranes: budding formation, diffusion of transmembrane proteins and line tension". The 2016 World Congress on Advances in Civil, Environmental & Materials Research (ACEM 16), Jeju, Korea (2016)
10. T. Belay, **C.I. Kim**, and P. Schiavone. "The role of line tension on budding formation induced by diffusion of proteins on lipid bilayer, The 24th International Congress of Theoretical and Applied Mechanics (ICTAM 2016), Montreal, Canada (2016)
11. **C.I. Kim** and D.J. Steigmann "Continuum based modeling and analysis of biomembranes: thickness distension and boundary interactions". International Symposium on Material Science and Technology, Seoul, Korea (2016)
12. **C.I. Kim** and D.J. Steigmann, "Mechanics of lipid membranes subjected to thickness distension and boundary interactions". Society of Natural Philosophy. Society of Natural Philosophy, Calgary, Canada (2015)
13. **C.I. Kim**, "Biological Membranes: Modeling and analysis", Canada-Korea Conference on Science and Technology (CKC 2015), Kananaskis, Canada, 2015-07-26 (2015)
14. **C.I. Kim**, "Gradient Elasticity on the Mechanics of Composites Reinforced with Finley Dispersed Fibers with Bending Resistance". Symposium on Multiscale & Multiphysics Mechanics (MMM'14). Symposium on Multiscale & Multiphysics Mechanics, Gyeongju, , 2014-12-04 (2014)
15. **C.I. Kim**, P. Schiavone and C-Q Ru, C-Q, "Effects of Boundary Reinforcement on Local Singular Fields in Linear Elastic Materials." Society of Engineering Science (SES),Brown University, Rhode Island, United States (2013)
16. **C.I. Kim**, P. Schiavone and C-Q Ru, C-Q, "Plane-strain Interface Crack in the Presence of Surface in Linear Elastic Materials." International Conference of Material Modeling, Paris, France (2011)
17. **C.I. Kim**, P. Schiavone and C-Q Ru, C-Q, "An Analysis of the Effects of Surface Elasticity on an Elastic Solid Incorporating a Crack (Mode-I & II): Complete Solution." Society of Engineering Science (SES), Iowa State University, Ames, Iowa, USA (2010)
18. **C.I. Kim**, P. Schiavone and C-Q Ru, C-Q, "The Effects of Surface Elasticity on an Elastic Solid with a Crack (Mode-I, II & III): Complete Solution," International Union of Theoretical and Applied Mechanics (IUTAM), Peking University, Beijing, China (2010)

19. **C.I. Kim**, P. Schiavone and C-Q Ru, C-Q, "The Effects of Surface Elasticity on an Elastic Solid with a Crack." *Advances in Interaction & Multiscale Mechanics (AIMM)*, Jeju, Korea (2010)
20. **C.I. Kim**, P. Schiavone and C-Q Ru, C-Q, "The Effects of Surface Elasticity on an Elastic Solid with Mode-III Crack." *Canadian Congress of Applied Mechanics (CANCAM)*, Halifax, Dalhousie University (2009)
21. **C.I. Kim**, P. Schiavone, "A Circular Inhomogeneity Subjected to Nonuniform Remote Loading in Finite Plane Elastostatics." *Canadian Congress of Applied Mechanics (CANCAM)*, Toronto, Ryerson University (2007)
22. **C.I. Kim**, G.J. Han, J.J. Sim, D.S. Han, S.U. Lee and T.H. Kim, "A Study on Stability of the Container Crane with Respect to the Direction of Wind Load." *Korean Society for Precision Engineering (KSPE)*, Deagu, Yungnam University, Korea (2004)