

TAEKSANG LEE

Myongji University
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EDUCATION

- 2016-2020 **Purdue University**, West Lafayette, IN, USA
Ph.D. in Mechanical Engineering
Advisor: Prof. Adrian Buganza Tepole
Dissertation: Improving Reconstructive Surgery through Computational Modeling of Skin Mechanics
- 2014-2016 **Sungkyunkwan University**, Suwon, S. Korea
M.S. in Mechanical Engineering
Advisor: Prof. Moon Ki Kim
Thesis: A Direct Methodology for Prediction of Creep Life Based on Small Punch Creep Test
- 2008-2014 **Sungkyunkwan University**, Suwon, S. Korea
B.S. in Mechanical Engineering

EMPLOYMENT AND RESEARCH EXPERIENCE

- 2021-present **Assistant Professor**
Department of Mechanical Engineering, Myongji University, Yongin, S. Korea
- 2020-2021 **Staff Engineer**
Mechatronics R&D Center, Samsung Electronics Co., Ltd, Hwaseong, S. Korea
- 2016-2020 **Research Assistant**
School of Mechanical Engineering, Purdue University, West Lafayette, IN, USA
- Summer 2015 **Visiting Student** (sponsored by **BK21 plus**)
Multiscale Biofabrication and Tissue Engineering Laboratory
University of Washington at Seattle, Seattle, WA, USA
- 2014-2016 **Research Assistant**
School of Mechanical Engineering, Sungkyunkwan University, Suwon, S. Korea

Fall 2013 **Undergraduate Research Assistant**
School of Mechanical Engineering, Sungkyunkwan University, Suwon, S. Korea

Winter 2012 **Internship**
Machinery Design Team, Samsung Heavy Industries Co., Ltd, Geoje, S. Korea

JOURNAL PUBLICATIONS

- [17] Ro, U., Kim, S., Kim, M. K.[#], and **Lee, T.**[#], “Creep Constitutive Modeling using Gaussian Process Regression: A Case Study on 9Cr-1Mo Steel,” Submitted.
- [16] Han, T., Ahmed, K. S., Gosain, A. K., Buganza Tepole, A., and **Lee, T.**, “Multi-fidelity Gaussian process surrogate modeling of pediatric tissue expansion,” *Journal of Biomechanical Engineering*, Vol. 144(12), 121005, 2022
- [15] Song, G., An, J., Buganza Tepole, A., and **Lee, T.**, “Bayesian inference with Gaussian process surrogates to characterize anisotropic mechanical properties of skin from suction tests,” *Journal of Biomechanical Engineering*, Vol. 144(12), 121003, 2022
- [14] Kim, S., Ro, U., Kim, Y. H., **Lee, T.**, and Kim, M. K. “Evaluation of Creep Properties Using Small Punch Creep Test for Modified 9Cr-1Mo Steel,” *Journal of Mechanical Science and Technology*, Vol. 36, pp. 4549–4561, 2022
- [13] Han, T.[#], **Lee, T.**[#], Ledwon, J. K., Vaca, E. E., Turin, S. Y., Kearney, A., Gosain, A. K., and Buganza Tepole, A., “Bayesian Calibration of a Computational Model of Tissue Expansion based on a Porcine Animal Model,” *Acta Biomaterialia*, Vol. 137, pp.136-146, 2022
- [12] **Lee, T.**, Holland, M. A., Weickenmeier, J., Gosain, A. K., and Buganza Tepole, A., “The Geometry of Incompatibility in Growing Soft Tissues: Theory and Numerical Characterization,” *Journal of the Mechanics and Physics of Solids*, Vol. 146, 104177, 2021
- [11] Stowers, C., **Lee, T.**, Billionis, I., Gosain, A. K., and Buganza Tepole, A., “Improving Reconstructive Surgery Design using Gaussian Process Surrogates to Account for Material Behavior Uncertainty,” *Journal of the Mechanical Behavior of Biomedical Materials*, Vol. 118, 104340, 2021
- [10] Enriquez, A., Libring, S., Field, T. C., Jimenez, J., **Lee, T.**, Park, H., Satoski, D., Wendt, M. K., Calve, S., Buganza Tepole, A., Solorio, L., Lee, H., “High-Throughput Magnetic Actuation Platform for Evaluating the Effect of Mechanical Force on 3D Tumor Microenvironment,” *Advanced Functional Materials*, Vol. 31(1), 2005021, 2021
- [9] **Lee, T.**[#], Turin, S. Y.[#], Stowers, C., Gosain, A. K., Buganza Tepole, A., “Personalized computational models of tissue-rearrangement in the scalp predict the mechanical stress signature of rotation flaps,” *The Cleft Palate-Craniofacial Journal*, Vol. 58(4), pp.438-445, 2021
- [8] Janes, L. E., Ledwon, J. K., Vaca, E. E., Turin, S. Y., **Lee, T.**, Buganza Tepole, A., Gosain, A. K., “Modeling Tissue Expansion with Isogeometric Analysis: Skin Growth and Tissue Level Changes in the Porcine Model”. *Plastic and Reconstructive Surgery*, Vol. 146(4), pp.792-798, 2020
- [7] **Lee, T.**, Billionis, I., Buganza Tepole, A., “Propagation of uncertainty in the mechanical and biological response of growing tissues using multi-fidelity Gaussian process

- regression,” *Computer Methods in Applied Mechanics and Engineering*, Vol. 359, 112724, 2020
- [6] **Lee, T.**, Gosain, A. K., Bilonis, I., Buganza Tepole, A., “Predicting the effect of aging and defect size on the stress profiles of skin from advancement, rotation and transposition flap surgery,” *Journal of the Mechanics and Physics of Solids*, Vol. 125, pp.572-590, 2019
- [5] **Lee, T.**, Turin, S. Y., Gosain, A. K., Bilonis, I., Buganza Tepole, A., “Propagation of material behavior uncertainty in a nonlinear finite element model of reconstructive surgery,” *Biomechanics and Modeling in Mechanobiology*, Vol. 17(6), pp.1857-1873, 2018
- [4] **Lee, T.**, Turin, S. Y., Gosain, A. K., Buganza Tepole, A., “Multi-view stereo in the operating room allows prediction of healing complications in a patient-specific model of reconstructive surgery,” *Journal of Biomechanics*, Vol. 74, pp. 202-206, 2018
- [3] **Lee, T.**, Vaca, E. E., Ledwon, J. K., Bae, H., Topczewska, J. M., Turin, S. Y., Kuhl, E., Gosain, A. K., Buganza Tepole, A., “Improving tissue expansion protocols through computational modeling,” *Journal of the Mechanical Behavior of Biomedical Materials*, Vol. 82, pp. 224-234, 2018
- [2] **Lee, T.**[#], Lee, H.[#], Kang, S. J., Ibupoto, F. A., Lee, J. M., Lee, J. H., Kim, B. J., Choi, J. B., Bae, S., Kim, M. K., “Small Punch Test and Simulation of HR3C Steel,” *Journal of Mechanical Science and Technology*, Vol. 32(7), pp. 3115-3121, 2018
- [1] **Lee, T.**, Ibupoto, F. A., Lee, J. H., Kim, B. J., Kim, M. K., “A Direct Methodology for Small Punch Creep Test,” *Experimental Mechanics*, Vol. 56(3), pp. 395-405, 2016

(# DENOTES EQUAL CONTRIBUTION)

CONFERENCE PRESENTATIONS

- [35] **Lee, T.**^{*}, Song, G., Buganza Tepole, A., “Characterization of Anisotropic Mechanical Properties of Skin using a Suction Device and Bayesian Inference,” 17th US National Congress on Computational Mechanics, Albuquerque, New Mexico, July, 2023
- [34] Song, G.^{*}, Shim, G., Gosain, A. K., Buganza Tepole, A., **Lee, T.**, “Patient-specific virtual surgery simulation using finite element method,” 17th US National Congress on Computational Mechanics, Albuquerque, New Mexico, July, 2023
- [33] Song, G.^{*}, Shim, G., Lee, J., **Lee, T.**, “Uncertainty analysis over hyper-viscoelastic parameters of skin in virtual surgery simulation,” The KSME Spring Conference, Busan, S. Korea, May, 2023
- [32] Kim, S.^{*}, Ro, U., **Lee, T.**, Kim, M. K., “Development of creep property evaluation method according to friction of small punch test,” The KSME Spring Conference, Busan, S. Korea, May, 2023
- [31] **Lee, T.**^{*}, Song, G., “Methodology to measure anisotropic properties of skin using Bayesian inference,” The KSME Spring Conference, Busan, S. Korea, May, 2023
- [30] Song, G.^{*}, Shim, G., **Lee, T.**, “Uncertainty analysis over hyper-viscoelastic properties through patient-specific virtual reconstructive surgery simulations,” Spring Conference of the Korean Society for Precision Engineering, Jeju, S. Korea, May, 2023
- [29] **Lee, T.**^{*}, “Computational Modeling of Growth and Incompatibility of Soft Tissues using Finite Element Method,” Winter Conference of the Biomedical Engineering Society for Circulation, Seoul, S. Korea, December, 2022

- [28] Ro, U.* , Kim, S., Kim, Y., **Lee, T.**, Kim, M. K., “[Data-Driven Creep Simulation Based on Gaussian Process Regression for 9% Cr Steel](#),” International Mechanical Engineering Congress & Exposition, Columbus, Ohio, November, 2022
- [27] Song, G.* , An, J., **Lee, T.**, “[Personalized Computational Models of Scalp Tissue Rearrangement and Stress Analysis](#),” Joint Conference of the Korean Society of Biomechanics & Korean Society of Sport Biomechanics, Chungju, S. Korea, November, 2022
- [26] Song, G.* , Buganza Tepole, A., **Lee, T.**, “[Prediction of Mechanical Properties and Anisotropy of Skin through Bayesian Inference](#),” Joint Conference of the Korean Society of Biomechanics & Korean Society of Sport Biomechanics, Chungju, S. Korea, November, 2022
- [25] **Lee, T.*** , Buganza Tepole, A., “[Computational modeling of skin growth induced by tissue expansion](#),” Joint Conference of the Korean Society of Biomechanics & Korean Society of Sport Biomechanics, Chungju, S. Korea, November, 2022
- [24] **Lee, T.*** , “[Uncertainty Analysis in Tissue Growth and Remodeling using Multi-fidelity Gaussian Process Metamodel](#),” Fall Conference of the Korean Society for Precision Engineering, Daegu, S. Korea, October, 2022
- [23] Song, G.* , Buganza Tepole, A., **Lee, T.**, “[Mechanical Characterization of Anisotropic Mechanical Properties of Skin using Suction Tests and Bayesian Inference](#),” Fall Conference of the Korean Society for Precision Engineering, Daegu, S. Korea, October, 2022
- [22] Song, G.* , An, J., **Lee, T.**, “[Prediction of Stress Signature on Scalp using Personalized Computational Models of Reconstructive Surgery](#),” Fall Conference of the Korean Society for Precision Engineering, Daegu, S. Korea, October, 2022
- [21] Ro, U.* , Kim, S., **Lee, T.**, Kim, M. K., “[Machine learning based parameter-free creep model for 9% Cr steel](#),” The KSME Spring Conference, Busan, S. Korea, May, 2022
- [20] Song, G.* , An, J., **Lee, T.**, “[Personalized computational model of reconstructive surgery including viscoelastic effect of skin](#),” Spring Conference of the Korean Society for Precision Engineering, Jeju, S. Korea, May, 2022
- [19] **Lee, T.*** , Buganza Tepole, A., “[Quantifying Incompatibility in Growing Tissues and Its Connection to Residual Stresses](#),” Summer Biomechanics Bioengineering Biotransport Conference, Virtual Meeting, June, 2020
- [18] **Lee, T.*** , Bilonis, I., Buganza Tepole, A., “[Uncertainty Analysis of Skin Growth During Tissue Expansion Using Multi-Fidelity Gaussian Process Regression](#),” Summer Biomechanics Bioengineering Biotransport Conference, Virtual Meeting, June, 2020
- [17] Stowers, C.* , **Lee, T.**, Bilonis, I., Buganza Tepole, A., “[Understanding the Effect of Material Behavior Uncertainty Including Anisotropy on the Biomechanics of Reconstructive Surgery Flaps Using Surrogate Models](#),” Summer Biomechanics Bioengineering Biotransport Conference, Virtual Meeting, June, 2020
- [16] **Lee, T.**, Turin, S. Y.* , Stowers, C., Gosain, A. K., Buganza Tepole, A., “[Virtual Surgical Planning of Tissue Transfer: Welcome Multi-View Stereo and Finite Element Analysis](#),” 88th American Society of Plastic Surgeons (Plastic Surgery: The Meeting), San Diego, California, September, 2019
- [15] **Lee, T.*** , Buganza Tepole, A., “[Gaussian process surrogate model for reconstructive surgery finite element analysis](#),” 32nd US-Korea Conference on Science, Technology, and Entrepreneurship, Rosemont, Illinois, August, 2019

- [14] **Lee, T.***, Gosain, A. K., Bilionis, I., Buganza Tepole, A., “[Predicting the Effect of Aging and Flap Design on the Mechanical Stress Profiles of Skin Through Gaussian Process Surrogates](#),” 15th US National Congress on Computational Mechanics, Austin, Texas, July, 2019
- [13] **Lee, T.**, Rausch, M. K., Buganza Tepole, A.* , “[Personalized Simulation of Reconstructive Surgery in the Presence of Material Behavior Uncertainty](#),” Biomedical Engineering Society, Atlanta, Georgia, October, 2018
- [12] Turin, S. Y.* , **Lee, T.**, Berg, P., Gosain, A. K., Buganza Tepole, A., “[Application of Finite Element Analysis to Predict Skin Mechanical Stress on a Patient-Specific Model of Complex Local Tissue Rearrangement](#),” 10th Biennial World Society for Simulation Surgery Meeting, Chicago, Illinois, September, 2018
- [11] **Lee, T.***, Turin, S. Y., Gosain, A. K., Bilionis, I., Buganza Tepole, A., “[Quantifying the effect of material parameter uncertainty in patient-specific, physics-based modeling of reconstructive surgery](#),” World Congress of Biomechanics, Dublin, Ireland, July, 2018
- [10] **Lee, T.***, Vaca, E. E., Ledwon, J. K., Bae, H., Topczewsak, J. M., Turin, S. Y., Kuhl, E., Gosain, A. K., Buganza Tepole, A., “[Quantifying skin growth due to tissue expansion as a function of inflation volume and protocol duration](#),” World Congress of Biomechanics, Dublin, Ireland, July, 2018
- [9] **Lee, T.**, Vaca, E. E., Ledwon, J. K., Bae, H., Topczewsak, J. M., Turin, S. Y., Kuhl, E., Gosain, A. K., Buganza Tepole, A.* , “[Understanding skin growth in response to stretch at multiple scales](#),” Engineering Mechanics Institute conference, Boston, Massachusetts, May, 2018
- [8] Vaca, E. E.* , Buganza Tepole, A., **Lee, T.**, Ledwon, J. K., Bae, H., Topczewska, J. M., Gosain, A. K., “[Modeling Tissue Expansion with Isogeometric Analysis: Skin Growth is Correlated with Increased Latency After Expansion](#),” Plastic Surgery Research Council 62nd Annual Meeting, Durham, North Carolina, May, 2017
- [7] Kim, M. K.* , **Lee, T.**, Lee, J. H., Bae, S., “[A Novel Approach of Small Punch Creep Test](#),” International Mechanical Engineering Congress & Exposition, Phoenix, Arizona, November, 2016
- [6] **Lee, T.***, Kim, M. K., “[An advanced creep life prediction method based on small punch creep test](#),” The KSME Spring Conference, Jeju, South Korea, April, 2016
- [5] **Lee, T.***, Choi, J. B., Kim, M. K., “[Creep Life Prediction of Pressure Vessels Based on Small Punch Creep Test](#),” The KPVP Annual Conference, Gimcheon, South Korea, November, 2015
- [4] **Lee, T.***, Kim, M. H., Kim, M. K., “[Study on Equivalent Strain Analysis of Small Punch Creep Test Based on Membrane Stretching Theory](#),” The KSME Autumn Conference, Jeju, South Korea, November, 2015
- [3] **Lee, T.***, Choi, J. B., Kim, M. K., “[Analytical Study on Small Punch Creep Test for Creep Life Prediction](#),” Mechanical Engineering Seminar, Suwa, Japan, March, 2015
- [2] **Lee, T.***, Lee, J. H., Kim, B. J., Kim, M. K., Lim, B. S., Ibupoto, F. A., “[Development of a Creep Life Time Expectation Method Based on Small Punch Creep Test](#),” The KIMM Spring Conference, Daegu, South Korea, April, 2014
- [1] Lee, J. H., Kim, M. K., Kim, B. J., **Lee, T.***, Lim, B.S., “[Small Punch Creep Test Methodology and Life Evaluation](#),” The 2nd ACCEE, Phuket, Thailand, March, 2014

(* DENOTES PRESENTING AUTHOR)

INVITED TALKS AND SEMINARS

- [6] “[Predictive modeling and simulation for soft tissue mechanics](#),” School of Mechanical Engineering at Yonsei University, Seoul, S. Korea, May, 2023
- [5] “[Predictive modeling of soft tissue mechanics](#),” Department of Mechanical & System Design Engineering at Hongik University, Seoul, S. Korea, April, 2023
- [4] “[Computational modeling of skin mechanics and uncertainty analysis in mechanical and biological response of skin](#),” School of Mechanical Engineering at Sungkyunkwan University, Suwon, S. Korea, May, 2022
- [3] “[Computational modeling of skin mechanics and uncertainty analysis in mechanical and biological response of skin](#),” Korean Society of Medical and Biological Engineering, Virtual Conference, May, 2022
- [2] “[Computational modeling of skin mechanics and uncertainty analysis in mechanical and biological response of skin](#),” Spring Conference of the Korean Society for Precision Engineering, Jeju, S. Korea, May, 2022
- [1] “[Development of virtual surgery simulation using patient-specific modeling and study on the effect of uncertainty over mechanical properties of skin](#),” Annual Conference of the Korean Society of Biomechanics, Seoul, S. Korea, December, 2021

AWARDS AND HONORS

- 2022 **Best paper award**, Korean Society of Biomechanics
- 2020 **KSEA-KUSCO Graduate scholarship**, Korean-American Scientists and Engineers Association
- 2019 **KSEA/KOSEN best poster award**, UKC 2019
- 2016 **Excellence award for oral presentation**, School of Mechanical Engineering, Sungkyunkwan University
- 2016 **Outstanding thesis award**, Sungkyunkwan University
- Spring 2013 **Academic merit-based scholarship**, Sungkyunkwan University
- Spring 2009 **Academic merit-based scholarship**, Sungkyunkwan University

RESEARCH INTERESTS

- **Computational solid mechanics:** Stress analysis for patient-specific model and generic flap design in reconstructive surgery based on nonlinear finite element analysis to elucidate effects of mechanical stress in wound healing and scar formation.
- **Soft tissue growth and remodeling:** Characterization of the mechanics and mechanobiology of tissue growth and remodeling using continuum mechanics and isogeometric analysis.
- **Uncertainty quantification:** Development of Bayesian surrogate models using Gaussian process regression with multi-level and multi-fidelity information; reduced order models to propagate uncertainty over mechanical and biological responses of soft tissues.

- **Numerical characterization:** Quantification of incompatibility by nonuniform growth field to reveal the interplay between biological growth and residual stress.

TEACHING EXPERIENCE

- **Machine Component Design**, Undergraduate Level
Spring 2023
Mechanical Engineering, Myongji University, Yongin, S. Korea
- **Applied Mathematics I**, Graduate Level
Fall 2022
Mechanical Engineering, Myongji University, Yongin, S. Korea
- **Finite Element Method**, Undergraduate Level
Spring 2022, Spring 2023
Mechanical Engineering, Myongji University, Yongin, S. Korea
- **Solid Mechanics**, Undergraduate Level
Spring 2022
Mechanical Engineering, Myongji University, Yongin, S. Korea
- **Introduction to Engineering Design**, Undergraduate Level
Fall 2021, Fall 2022
Mechanical Engineering, Myongji University, Yongin, S. Korea
- **Introduction to Finite Element Analysis**, Undergraduate Level
Fall 2018, Spring & Fall 2019
Teaching Assistant, Mechanical Engineering, Purdue University, West Lafayette, IN, USA
- **Solid Mechanics Design Laboratory**, Undergraduate Level
Fall 2014, Spring & Fall 2015
Teaching Assistant, Mechanical Engineering, Sungkyunkwan University, Suwon, S. Korea
- **Microstructure and Mechanical Properties**, Graduate Level
Spring 2014
Teaching Assistant, Mechanical Engineering, Sungkyunkwan University, Suwon, S. Korea

ACADEMIC SERVICE

- **Reviewer**
Acta Biomaterialia, Engineering with Computers
- **Board Member**
Korean Society of Biomechanics, Bio & Health section in Korean Society for Precision Engineering