

# Yong Guk Kang

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## SUMMARY

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Senior Research Engineer at Seoul National University's Institute of Advanced Machines and Design, working with the Imaging Intelligence Laboratory on computational imaging, inverse optical design, lensless imaging, quantitative phase imaging, and biomedical photonics. My research connects optical system modeling, wave-optics simulation, and data-driven reconstruction for imaging problems where hardware design and computational inference must be considered together.

## CURRENT RESEARCH INTERESTS

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- Computational imaging and inverse optical design
- Lensless and phase-coded imaging systems
- AI-assisted image reconstruction and virtual staining
- Quantitative phase, interferometric, and coherent imaging
- Physics-informed modeling of optical imaging systems

## PREVIOUS RESEARCH THEMES

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- Optical coherence microscopy for cell and tissue dynamics
- Nonlinear microscopy for cell-ECM mechanical interactions
- Biomedical photonics and quantitative bioimage analysis
- Fluorescence optical mapping and multimodal microscopy

## POSITIONS

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**Senior Research Engineer**, Seoul National University, Institute of Advanced Machines and Design (2025-04-present)

- Developing computational imaging frameworks that combine optical system modeling, inverse design, and data-driven reconstruction.
- Investigating lensless and phase-coded imaging strategies for high-dynamic-range and information-rich optical measurements.
- Applying physics-informed simulation and machine learning to jointly reason about optical encoding and image reconstruction.

**Researcher**, Yonsei University, School of Electrical and Electronic Engineering (2024-04-2025-02)

- Contributed to computational imaging and lensless imaging research in the Imaging Intelligence Laboratory.
- Worked on phase-coded optical systems, wave-optics modeling, and reconstruction-oriented imaging methods.
- Collaborated on compact optical imaging platforms and biomedical imaging applications.

**Postdoctoral Researcher**, Korea University, School of Biomedical Engineering (2022-09-2024-03)

- Advanced reflection phase microscopy for efficient 3D quantitative imaging with reduced axial scanning.
- Developed computational refocusing and field synthesis strategies for reflection phase measurements.
- Integrated optical modeling and experimental validation for interferometric biomedical imaging.

**Research Lecturer**, Korea University, School of Medicine (2020-10-2022-08)

- Developed optical coherence microscopy approaches for quantifying cell-ECM interactions and intracellular dynamics.
- Applied temporal-dynamics contrast imaging to live-cell and tissue-scale biomedical measurements.

- Connected optical imaging measurements with quantitative analysis of mechanical interactions in biological matrices.

## EDUCATION

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**Ph.D. in Biomedical Engineering**, Korea University (2014-03-2020-08)

Thesis: Development of a multiphoton and optical coherence microscope for visualization and analysis of cell-extracellular matrix interactions

- Implemented live-cell multiphoton and optical coherence microscopy for cell and tissue imaging.
- Analyzed 3D matrix deformation using digital volume correlation.

**B.S. in Biomedical Engineering**, Korea University (2008-03-2014-02)

## SELECTED CAPABILITIES

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**Computational imaging:** Wave-optics simulation, Inverse problems and image reconstruction, Machine learning assisted optical design and reconstruction

**Optical imaging:** Quantitative phase imaging, Interferometric microscopy, Optical coherence microscopy, Nonlinear microscopy

**Tools:** MATLAB, Python, PyTorch, ZEMAX, Fusion 360, ImageJ

## JOURNAL ARTICLES

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Hyesuk Chae and Kyungwon Lee and Yong Guk Kang and Hansol Yoon and Kyung Chul Lee and Seung Ah Lee. **Pupil Plane Multiplexing for Vectorial Fourier Ptychography**. *Laser & Photonics Reviews*, 2026.

Yong Guk Kang and Donggeon Bae and Jaewoo Jung and Sangjun Byun and Hyo Jun Ahn and Hojin Chang and Joonsik Park and Hyeonyong Lee and Seung Ah Lee. **Geometry-aware phase compensation for sampling-efficient angular spectrum method**. *Optics Express*, 2026.

Yong Guk Kang and Hyesuk Chae and Seung Ah Lee. **Computational space-bandwidth product expansion via multiscale aperture synthesis and wavefront engineering**. *Advanced Imaging*, 2026.

Kyung Chul Lee and Hyesuk Chae and Jongho Kim and Lucas Kreiss and Hyeongyu Kim and Yong Guk Kang and Kevin C. Zhou and Amey Chaware and Kanghyun Kim and Shiqi Xu and Suki Kang and Geunbae Bang and Nam Hoon Cho and Dosik Hwang and Roarke Horstmeyer and Seung Ah Lee. **Semi-supervised virtual staining using learned-illumination Fourier ptychography for high-speed label-free histopathology**. *Journal of Physics: Photonics*, 2026.

Yongjun Jang and Myeongjin Kang and Yong Guk Kang and Dongtak Lee and Hyo Gi Jung and Dae Sung Yoon and Jongseong Kim and Yongdoo Park. **Cardiac fibroblast-mediated ECM remodeling regulates maturation in an in vitro 3D engineered cardiac tissue**. *Journal of Tissue Engineering*, 2025.

Kwanjun Park and Taeseok Daniel Yang and Yong Guk Kang and Taeyoon Kong and Youngwoon Choi. **Wide-area topography using reflection phase microscopy for surface inspection**. *Optics Express*, 2025.

Yong Guk Kang and Kwanjun Park and Min Gu Hyeon and Taeseok Daniel Yang and Youngwoon Choi. **Three-dimensional imaging in reflection phase microscopy with minimal axial scanning**. *Optics Express*, 2023.

Hyun-Joong Kim and Se-Hwan Um and Yong Guk Kang and Myeongjin Shin and Hyeon Jeon and Beop-Min Kim and Dongtak Lee and Kisoo Yoon. **Laser-tissue interaction simulation considering skin-specific data to predict photothermal damage lesions during laser irradiation**. *Journal of Computational Design and Engineering*, 2023.

Yong Guk Kang and R. J. E. Canoy and Yujin Jang and A. R. M. P. Santos and Inseong Son and Beop-Min Kim and Yongdoo Park. **Optical coherence microscopy with a split-spectrum image reconstruction method for temporal-dynamics contrast-based imaging of intracellular motility**. *Biomedical Optics Express*, 2023.

Boram Lee and Eunsoo Lee and June Hoan Kim and Hyung Jin Kim and Yong Guk Kang and Hyun Jung Kim and Jin Kyoung Shim and Seok Gu Kang and Beop-Min Kim and Karam Kim and Youseok Kim and Keunchang Cho and

Woong Sun. **Sensitive label-free imaging of brain samples using FxClear-based tissue clearing technique.** *iScience*, 2021.

Yong Guk Kang and Hwanseok Jang and Yongdoo Park and Beop-Min Kim. **Development of a 3-D Physical Dynamics Monitoring System Using OCM with DVC for Quantification of Sprouting Endothelial Cells Interacting with a Collagen Matrix.** *Materials*, 2020.

Min Gu Hyeon and Taeseok Daniel Yang and Jong Su Park and Kwanjun Park and Yong Guk Kang and Beop-Min Kim and Youngwoon Choi. **Reflection Phase Microscopy by Successive Accumulation of Interferograms.** *ACS Photonics*, 2019.

Yong Guk Kang and Hwanseok Jang and Taeseok Daniel Yang and Jacob Notbohm and Youngwoon Choi and Yongdoo Park and Beop-Min Kim. **Quantification of focal adhesion dynamics of cell movement based on cell-induced collagen matrix deformation using second-harmonic generation microscopy.** *Journal of Biomedical Optics*, 2018.

Taeseok Daniel Yang and Kwanjun Park and Yong Guk Kang and Kyoung J. Lee and Beop-Min Kim and Youngwoon Choi. **Single-shot digital holographic microscopy for quantifying a spatially-resolved Jones matrix of biological specimens.** *Optics Express*, 2016.

Chang-Hee Han and Hyuna Song and Yong-Guk Kang and Beop-Min Kim and Chang-Hwan Im. **Hemodynamic responses in rat brain during transcranial direct current stimulation: a functional near-infrared spectroscopy study.** *Biomedical Optics Express*, 2014.

## CONFERENCE PAPERS

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Hyo Jun Ahn and Tae-Yong Kim and Hojin Chang and Yong Guk Kang and Hyeonyong Lee and Donggeon Bae and Changyoon Yi and Kyung Chul Lee and Nakkyu Baek and Joonsik Park and Seung Ah Lee. **A compact, bite-down lensless imager for 3D fluorescence mapping of occlusal dental plaque.** *Computational Optical Imaging and Artificial Intelligence in Biomedical Sciences III*, 2026.

Hyesuk Chae and Kyung Chul Lee and Yong Guk Kang and Jongho Kim and Kyungwon Lee and Suki Kang and Geunbae Bang and Nam Hoon Cho and Seung Ah Lee. **High-speed virtual re-staining via near-infrared quantitative phase imaging.** *Proceedings of SPIE Advanced Biophotonics Conference*, 2026.

Yong Guk Kang and Donggeon Bae and Nakkyu Baek and Hyojun Ahn and Taeyoung Kim and Kyung Chul Lee and Seung Ah Lee. **Non-Paraxial Layered Diffraction Simulator for Inverse Design of Lensless Imaging Optics.** *Optica Imaging Congress 2025*, 2025.

## PROJECTS

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**Lensless and HDR computational imaging.** Computational imaging research on lensless and phase-coded acquisition, with emphasis on optical encoding, inverse design, and robust reconstruction under challenging measurement conditions.

**Reflection phase microscopy.** Quantitative reflection phase microscopy for efficient 3D surface and biomedical imaging, combining interferometric measurement design with computational refocusing and field synthesis.

**Optical coherence microscopy for cell-ECM dynamics.** Optical coherence microscopy and temporal-dynamics contrast imaging for studying cell, tissue, and extracellular matrix interactions.

**Live-cell nonlinear microscopy for matrix deformation analysis.** Nonlinear microscopy and quantitative image analysis for studying collagen matrix deformation and cell-ECM mechanical interactions.

## FUNDING, FELLOWSHIPS, AND PATENTS

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**Funding:** Creative and Challenging Research Base Support, National Research Foundation of Korea (2021R111A1A01048370)

**Fellowship:** Global Ph.D. Fellowship, National Research Foundation of Korea (2015H1A2A1030048)

**Patent:** Head mount system for providing surgery support image, United States Patent (US 11,356,651)

**Patent:** Reflection phase microscopy system for 3D image acquisition, Korea Patent (10-2024-0081557)

**Patent:** Phase mask fabrication method based on grayscale lithography, Korea Patent (10-2024-0161144)