

# Resume - Ravi K. Komanduri

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## RESEARCH INTERESTS

Optical system design and modeling, electro-optics, flat-panel displays, projection displays, Liquid Crystal Displays (LCDs), lasers, Light Emitting Diodes (LEDs), optical characterization, spectroscopy, thin film optical coatings, diffraction gratings, holography, lithography, liquid crystals, organic electronics, and solid-state device physics.

## EDUCATION

**Ph.D. Electrical Engineering, May 2009**

North Carolina State University, Raleigh, NC - C.G.P.A. **4.0/4.0**

**B.Tech. Electrical Engineering, May 2004**

Indian Institute of Technology Madras, Chennai, India - C.G.P.A. **8.24/10.0**

## RESEARCH EXPERIENCE

**Post-Doctoral Researcher (2009-Present)**- Collaboration between Department of Electrical and Computer Engineering, North Carolina State University & ImagineOptix™ Corporation

- Demonstrated a novel arrangement of diffractive elements with standard LCOS microdisplays, leading to a prototype pico-projector that is more energy efficient, compact, and cheaper than other conventional approaches (being commercialized by *ImagineOptix™*). So far three generations of pico-projector modules have been already produced.
- Supervised and assisted an international team in the large scale manufacturing of new pre-polarizing elements for a commercial projector (Coordinated with LG Innotek, Korea; and ColorLink, Japan).
- Developed new lithographic techniques for fabricating holographic elements using partially coherent light sources. These new approaches have significant impact on high volume manufacturing of such elements.
- Designed a novel liquid crystal light switch that performs as a high throughput, polarization insensitive variable optical attenuator. Preliminary research results show promise for phase-II funding toward an extensive project with a defense contractor.
- Conceptualized and automated (LabVIEW) a novel characterization tool for efficiently measuring polarization properties of anisotropic optical elements. This low budget system consisted of standard components, and improved measurement efficiency ten-fold.

**Research Assistant (2006-2009)** – Opto-electronics and Lightwave Engineering Group (OLEG)

Department of Electrical and Computer Engineering, North Carolina State University

Dr. Michael Escuti, Ph.D. Advisor

**Dissertation Focus:** Demonstrated the first viable polarizer-free Liquid Crystal Projection display technology using Polarization Gratings, that is twice as energy efficient as conventional LCDs (Funded by National Science Foundation)

- Analyzed novel optical elements using Finite Difference Time Domain (FDTD) techniques, and other modeling packages (*LC3D™*) to lay out foundational design rules, critical for several applications including displays, tunable filters, beam-steering, etc.
- Constructed prototype projection systems by integrating these new elements with commercial microdisplays, and other standard optics. These provided twice the optical throughput and luminous efficacy as conventional approaches, serving as proof of concept for successive pico-projector modules.
- Developed fabrication approaches for manufacturing new diffractive elements, and characterized their optical performance.
- Designed low cost modular lab experiments for fabrication and characterization of organic electronic devices including LCDs, OLEDs, solar cells, and organic transistors.
- Mentored and trained several undergraduate researchers in collaboration with OLEG.

## ADDITIONAL EXPERIENCE

### Teaching Assistant (2004-2006)

Department of Electrical and Computer Engineering, North Carolina State University

- Served as Head Teaching Assistant for undergraduate Electrical Engineering course (ECE200) at NCSU (2006). Supervised several teaching assistants and managed laboratory equipment. Guided undergraduate students through various experiments involving application of fundamental concepts.

### Independent Research Study (2005)

Supervisor: Dr. Michael Escuti, North Carolina State University,

- Modeled novel photonic crystal structures using MIT Photonic Bands (MPB) package

### Undergraduate Research Assistant (2003-2004)

Department of Electrical Engineering, Indian Institute of Technology Madras, India

- Developed analytical models for predicting Electrical Trimming properties of Poly-Crystalline Silicon resistors with varying grain size.

### Summer Internship (2003)

Electronics Corporation of India Ltd. (ECIL), Hyderabad, India

- Investigated several digital counter models using simple FPGAs

## TECHNICAL SKILLS

5+ years hands on experience in a variety of processing, characterization, analysis, and software tools:

### Fabrication & Processing:

Spin-coaters, fume hoods, thin film deposition and etching. Certified user at NCSU Nanofabrication Facility (NNF).

### Optical Tools:

Optical tables, projection displays, spectrometers, beam-profilers, power meters, integrating spheres, polarization optics, spatial filters, lasers (UV, visible, IR), LEDs, MA-6 Aligner, microscopes, ellipsometers, profilometers, etc.

### Material Knowledge:

Organic materials, liquid crystals, photo-resists, common solvents, optical adhesives, and inorganic semiconductors.

### Computer Skills:

Well versed with common scientific and general purpose programming packages including MATLAB, C++, COMSOL, MAPLE, Mathematica, and Labview. Optical system design and modeling experience in TracePro.

## PATENT APPLICATIONS

- "Polarization-Independent Liquid Crystal Display Devices Including Multiple Polarization Grating Arrangements and Related Devices", filed 2008; Inventors: R. K. Komanduri, C. Oh, M. J. Escuti, B. L. Conover, and J. Kim
- "Low-Twist Chiral Liquid Crystal Polarization Gratings and Related Fabrication Methods", filed 2008; Inventors: R. K. Komanduri, C. Oh, and M. J. Escuti

## JOURNAL PUBLICATIONS

- R. K. Komanduri and M. J. Escuti, "High Efficiency Reflective Liquid Crystal Polarization Gratings," *Applied Physics Letters*, vol. **95**, 091106, 2009
- R. K. Komanduri and M. J. Escuti, "Elastic Continuum Analysis of the Liquid Crystal Polarization Grating," *Physical Review E*, vol. **76**, no. 2, num. 021701, 2007
- R. K. Komanduri, W. M. Jones, C. Oh, and M. J. Escuti, "Polarization-Independent Modulation for Projection Displays Using Small-Period LC Polarization Gratings," *Journal of the Society for Information Display*, vol. **15**, no. 8, pp. 589-594, 2007

## CONFERENCE PROCEEDINGS

- R. K. Komanduri, K. F. Lawler, and M. J. Escuti, "A high throughput liquid crystal light shutter for unpolarized light using polymer polarization gratings," *Proc. SPIE - Advanced Wavefront Control: Methods, Devices, and Applications VIII*, vol. **8052**, art. no. 80520R, 2011
- E. Seo, H. C. Kee, Y. Kim, S. Jeong, H. Choi, S. Lee, J. Kim, R. K. Komanduri, and M. J. Escuti, "Polarization Conversion System using A Polymer Polarization Grating," *SID Symposium Digest*, vol. **42**, pp. 540-543, 2011.
- R. K. Komanduri, C. Oh, and M. J. Escuti, "Polarization Independent Projection Systems Using Thin Film Polymer Polarization Gratings and Standard Liquid Crystal Microdisplays," *SID Symposium Proceedings*, vol. **40**, pp. 487-490, 2009
- R. K. Komanduri, C. Oh, and M. J. Escuti, "Reflective liquid crystal polarization gratings with high efficiency and small pitch," *Proc. SPIE - Liquid Crystals XII*, vol. **7050**, art. no. 70500J, 2008
- R. K. Komanduri, C. Oh, M. J. Escuti, and D. J. Kekas, "Late-News Paper: Polarization Independent Liquid Crystal Microdisplays," *SID Symposium Proceedings*, vol. **39**, pp. 236-239, 2008
- C. Oh, R. K. Komanduri, B. L. Conover, and M. J. Escuti, "Polarization-Independent Modulation Using Standard Liquid Crystal Microdisplays and Polymer Polarization Gratings," *International Display Research Conference*, vol. **28**, pp. 298-301, 2008
- C. Oh, R. K. Komanduri, and M. J. Escuti, "FDTD analysis of 100% efficient polarization-independent liquid crystal polarization grating," *Proceedings of the SPIE - Liquid Crystals X*, vol. **6332**, no. 633238, 2006
- C. Oh, R. K. Komanduri, and M. J. Escuti, "FDTD and elastic continuum analysis of the liquid crystal polarization grating," *SID Symposium Digest*, vol. **37**, pp. 844-847, 2006

## HONORS AND AWARDS

- Best oral presentation ECE-Graduate Student Association Seminar, NCSU Spring 2007
- Best poster presentation ECE-Graduate Student Association Seminar, NCSU Spring 2006
- Member of Phi Kappa Phi and Eta Kappa Nu

## SELECTED PRESENTATIONS

- Oral Presentation - (SID) Society for Information Display, Display Week 2009
- Oral Presentation - (SPIE) SPIE Optics and Photonics Conference 2008
- Poster Presentation - (SID) Society for Information Display, Display Week 2006

## REFERENCES

Michael J. Escuti  
**Assistant Professor**  
Department of ECE  
NC State University  
[mjescuti@ncsu.edu](mailto:mjescuti@ncsu.edu)

Dr. Mehmet C. Ozturk  
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