

Business Innovation in Optics and Photonics

Course Section 3

Technology Introduction

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Technology Basics to be summarized and presented by 6 Groups

Group 1: Micro-Display Technology LCD vs. OLED

Group 2: Color Management

Group 3: HMD - Optical Designs I: "Classical approach"

Group 4: HMD Optics Design II: "Planar approach"

Group 5: Low Cost Plastic Optics for Consumer Products

Group 6: Diffractive Optics

Group 1: Micro-Display Technology LCD vs. OLED

Key Questions and References

Key Questions

1. How does an LCD display work? (General architecture, comparison of different types (TN, MVA, IPS))
2. What are the specific challenges of an LCD microdisplay? (= RGB pixel pitch of $\leq 15\mu$)
3. How does an OLED display work? (General architecture)
4. What are specific challenges of an OLED microdisplay?
5. What are the most important performance differences of LCD and OLED microdisplays? (Key advantages of each technology, major applications)

References

1. David Armitage, Ian Underwood, Shin-Tson Wu, Introduction to Microdisplays, Wiley Series in Display Technology
2. <http://www.kopin.com/what-is-cyberdisplay/>
3. <http://www.emagin.com/technology/index.php>
4. <http://www.displaysearch.com/>
5. <http://www.eetimes.com/>
6. <http://www.ednmag.com/>
7. <http://www.electronicnews.com/>
8. <http://www.electronicstrendpubs.com/>

Group 2: Color Management

Key Questions and References

Key Questions

1. What does the term "color management" mean?
2. What are the key parameters and tools to do color management (color temperature, color space, ...)
3. What are major applications that require color management?

References

1. Herbert Gross, Handbook of Optical Systems, Wiley-VCH, 2005, Volume 1: Fundamentals of Technical Optics

Group 3: HMD - Optical Designs I: "Classical approach"

Key Questions and References

Key Questions

1. How does an microscope ocular work?
2. What are the key parameters to characterize an HMD?
3. What are the main differences of a microscope ocular to an HMD optics?

References

1. J. Melzer, K. Moffitt, Head-Mounted Displays, New York (1997), Mc Graw-Hill
2. Bertram Ahtner, Frank-Oliver Karutz, Michael Pollmann, Markus Seeßelberg, Videobrille für das Kino unterwegs, Photonik 01/2008

Group 4: HMD Optics Design II: "Planar approach"

Key Questions and References

Key Questions

1. How does the LUMUS HMD design work?
2. What are the advantages and disadvantages of the LUMUS approach vs. a "classical" HMD design?
3. What do you consider the main reason for this technology not being commercialized yet?

References

1. Yaakov Amitai, P-27: A Two-Dimensional Aperture Expander for Ultra-Compact, SID 2005 Digest
2. Yaakov Amitai, Extremely Compact High-Performance HMDs Based on Substrate-Guided Optical Element, SID 2004 Digest

Group 5: Low Cost Plastic Optics for Consumer Products

Key Questions and References

Key Questions

1. What are the major advantages and disadvantages of plastic optics vs. traditional glass optics?
2. Where are plastics and glass optics material in the Abbe-Diagramm and what are the main implications of that difference?
3. What are major applications of plastics optics?
4. How are plastic optics manufactured and what are the challenges (injection moulding and achievable accuracy vs. glass)

References

1. Herbert Gross, Handbook of Optical Systems, Wiley-VCH, 2005, Volume 1: Fundamentals of Technical Optics
2. Stefan Bäumer, Handbook of Plastic Optics, Wiley-VCH, 2005

Group 6: Diffractive Optics

Key Questions and References

Key Questions

1. Why are diffractive elements needed in many plastic optics applications?
2. How do they work in that context?
3. What are key challenges in this applications? (e.g. manufacturing)

References

1. H.P. Herzig, Micro-Optics: Elements, Systems and Applications, Academic Press 1997
2. J. Turunen and F. Wyrowski, Diffractive Optics: Industrial and Commercial Applications, Wiley 1998
3. T. Stone, N. George, Hybrid diffractive-refractive lenses and achromats, Appl. Optics 27, 2960-2971 (1988)