Komal Ojha

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EDUCATION

Indian Institute of Technology Bombay, 9.14 — Mumbai, India
Ph.D (soon-to-be graduate), Communication and Signal Processing — [Jul 2019-Present]

Malaviya National Institute of Technology, Jaipur, 8.7 — Rajasthan, India
M.Tech, Electronics & Communication Engineering — [Jul 2016-18]

Sir Padampat Singhania University, Udaipur, 8.4 — Rajasthan, India
B.Tech, Electronics and Communication Engineering — [Jul 2011-15]

Areas of Interest

Wireless & Optical Communication | Digital Signal Processing

Technical Skills

Programming	Python, C, C++
Softwares & Tools	MATLAB, Optilux, GNU Radio, COMSOL, Quartus Prime Lite
Instruments	Digital Oscilloscope (80GSa/s), Arbitrary Waveform Generator, Optical Amplifier Optical Coherent Receiver, Photodetector, Laser Source, IQ Modulator

THEME OF DOCTORAL RESEARCH

Topic: Space-Division-Multiplexed Intensity-Modulated Direct-Detection Fiber Channel Design
Guide: Prof. Kumar Appaiah, Electrical Engineering, IIT Bombay

Outline: The work focuses on elevating data rates in existing fiber channels through space division multiplexing, vital for Data Center Interconnect (DCI) efficiency. The primary focus is mitigating dispersion, a high-speed communication bottleneck, through optimized transceiver and optical fiber designs.

Projects

1. **Chromatic Dispersion Compensation: Incoherent vs Coherent Receiver** [2023-Present]
   - Mitigated Chromatic Dispersion (CD) in IM-DD Systems with DSP technique i.e. Kramers Kronig (KK) Receiver.
   - Implemented the KK algorithm with 50 Gbps, 16-QAM modulation in MATLAB (Optilux), and GNU Radio.
2. **Optimizing Offset Coupling in Mode Group Multiplexed MMF Links with Phase Retrieval** [2021-23]
   - Implemented multimode fiber channel in Python and addressed the challenge of modal dispersion.
   - Developed cost-effective direct-detection receiver solutions relying on intensity measurements using phase retrieval.
   - Demonstrated a 2×10 Gbps (10 GBaud, 2×2 Mode Group Diversity Multiplexed, OOK) link over 500m MMF.
3. **Optimizing graded-index few-mode fiber for space division multiplexing** [2021-22]
   - Designed and optimized a few-mode fiber using COMSOL, enabling efficient space division multiplexing.
   - Set a record-low 16 ps/km differential mode delay, reducing DSP complexity.
4. **Feedback-based Compensation of Second Order Modal Dispersion in Principal Mode-based Multiplexed MMF Links** [2020-21]
   - Implemented Linde-Buzo-Gray quantization techniques for precise Channel State information at the transmitter.
   - Determined optimal bits for quantization and improved data rate performance upto 100 Gbps.
5. **Wavelength Division Multiplexed Radio over Fiber Passive-Optical Network Based on Orthogonal Frequency Division Multiplexing (OFDM)** [2016-18]
   - Implemented OFDM, IFFT/FFT in MATLAB and simulated an optical fiber link using OptiSystem.
   - Compared Bit Error Rate (BER) for various modulation schemes, including DPSK, QAM, and PAM.

Experience

- **Teaching Assistant | IIT Bombay** [2020-Present]
  - DSP Lab, Digital Signal Processing and Its Applications, Digital Message Transmission
    - Assisted in DSP Lab experiments: DFT, FFT, Floating Point Representation, and Filter Design in GNU Radio.
    - Conducted DSP Project introduction seminar and Filter Design tutorial in Python.

Relevant Courses

Communication	Digital Message Transmission, Fibre Optic Comm., Information Theory & Coding
Signal Processing	Digital Signal Processing & its Application, Hardware Description Language
Probability & statistics	Applied Linear Algebra, Statistical Signal Analysis

SCHOLASTIC ACHIEVEMENTS

- **Certified SWAYAM NPTEL Topper** (Top 5%) in NPTEL course "Introduction to Wireless and Cellular Communication" offered in autumn 2022. [2022]
- Secured **All India Rank 656** (scored **722**) in GATE 2019 (Electronics and Communication). [2019]

Publications

1. **Komal Ojha**, Darpan Mishra, Kumar Appaiah, and Deepak Jain,"Optimizing graded-index few-mode fiber for space division multiplexing," Optics Express 31, 21784-21795 (2023).
2. **Komal Ojha** and Kumar Appaiah,"Phase Retrieval-based Optimized offset launch in Mode Group Diversity Multiplexed MMF links," under review with IEEE Transaction on Communication (2023).
3. **K. Ojha** and K. Appaiah, "Feedback-based Compensation of Second Order Modal Dispersion in Principal Mode based Multiplexed MMF Links," 2022 National Conference on Communications (NCC), 2022.
4. **Komal Ojha**, Darpan Mishra, Kumar Appaiah and Deepak Jain, "Breaking the Trade-Off between DMD and Crosstalk in Space Division Multiplexing through Graded-Index FMF," Poster Presentation at WORKSHOP ON ADVANCES IN OPTICAL COMMUNICATIONS 2023, IIT Madras.
5. **Komal Ojha**, Darpan Mishra, Kumar Appaiah and Deepak Jain, "Resolving the DMD-crosstalk trade-off in SDM through graded-index FMF," under review with SPIE Photonic west 2024 (Accepeted).
6. Darpan Mishra, **Komal Ojha**, Kumar Appaiah, and Deepak Jain, "Germania Glass-Based Negative-Curvature Hollow-Core Fiber for Mid-IR Applications," In Frontiers in Optics, Optica Publishing Group, 2022.

Workshops/Internship

- Workshop on Advances in Optical Communication organised by IIT Madras. [Jul 2023]
- SERB sponsored KARYASHALA Workshop on "Parallel computing: GPU, FPGA based computation for machine learning applications", IIT Indore. [Jul 2022]
- Python workshop conducted during the Entrepreneurship Summit 2021, at IIT Bombay. [Feb 2021]
- Webinar on "Multidimensional optical multiplexing" organized by IEEE Photonics Society Student Chapter, SPIE Student Chapter & IEEE Student Branch MNIT Jaipur, Feb 2021. [Feb 2021]
- Internship at BSNL with a project titled "Broadband, Switching and Transmission system". [Jun 2014]