Lightwave Communications Systems Research at the University of Kansas

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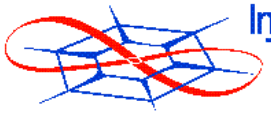

Lightwave Laboratory

Lightwave Communication Systems Laboratory

Our Mission is to . . .

- **Increase the capacity utilization of long distance lightwave communications networks;**
- **Train the next generation of engineers in the field of lightwave systems;**
- **Conduct research and publish results that contribute to the knowledge base in the lightwave arena;**
- **Provide value to local industry relating to the application of lightwave technologies;**
- **Establish and maintain a core competency in lightwave systems techniques.**

Lightwave Communication Systems Laboratory

- **The only state-of-the-art lightwave systems research laboratory in Kansas;**
- **Supported by Sprint, Lucent Technologies, NEC Corporation, the National Science Foundation (NSF), and the Kansas Technologies Enterprise Corporation (KTEC);**
- **Conducts research in a variety of areas including wavelength-division multiplexing (WDM), solitons, polarization-mode dispersion (PMD), photonic switching.**

Laboratory Infrastructure

- Started Jan. ‘96 (20 months ago)
- 600 ft^2 laboratory space
- Key test equipment includes
  - 12 GHz BERT, Tunable Laser, 50 GHz Scope
  - Polarization Analyzer, Optical Spectrum Analyzer
- Lucent FT-2000 8-λ WDM system
- Ciena 16-λ WDM system
- Soliton generator (built at KU)
- Recirculating loop (built at KU)
- Optical Clock Recovery (under development)

Background

- **Founded in Spring 1996**

  Support: $ 2,033,118 (Total)

  NSF - $ 210 K/yr through '99
  KTEC - $ 135K/yr through '99
  Sprint, Lucent, NEC - $ 1M/yr through '99

- **Its purpose is to:**
  - **Identify, characterize, develop, and recommend technologies that will expand the capabilities of the long-distance fiber networks**
  - **Evaluate the merits of new optical networking technologies**
  - **Promote university/industry interaction (NSF/KTEC)**

Participants

- **Faculty:**

  Ken Demarest (WDM Systems, Solitons)
  Chris Allen (WDM and Coherent Systems)
  Victor Frost (ATM, SONET, Networking)
  Joseph Evans (ATM,SONET, Networking)
  Karen Nordheden (Devices)
  Rongqing Hui (WDM Systems, Devices)

- **Postdoctoral Fellow:**
  Coming in November

- **Students:**
  9 Graduate, 1 undergraduate

Major Results and Technology Transfer

- Modulator Patent Application
- Three Papers: Photonics Letters (2), JLT (1)
- Two Presentations Accepted for LEOS'97
  - Experimental Study of Four-Wave Mixing in Non-zero Dispersion Fiber
  - Interactions Between Solitons and NRZ Signals in WDM Networks
- Technical Reports
  - Modeling PMD In Optical Fiber Links
  - Service Survivability of Fiber Networks: Photonic Networks, SONET and ATM
  - Evaluation of WDM System in SMF and DSF
- Fiber link simulator delivered to Sprint

Current Research Areas

- **High Speed Time-Division Multiplexing (TDM) and Solitons**
- **Optical Switching**
- **Modeling and Measurements**
- **Polarization Mode Dispersion**
- **Optical Networking**

Soliton-based Transmission Systems

- *Goals:*
  1. *Increase optical fiber transmission capacity.*
  2. *Soliton-transmission related all-optical switching and processing.*
- *What we've done*
  - *Built soliton generator*
  - *Assembled a recirculating loop*
  - *Demonstrated preliminary soliton transmission*
- *What we're planning to do*
  - *Dispersion-managed soliton/WDM transmission*
  - *Soliton/NRZ hybrid transmission*
  - *Soliton all-optical switching*

Optical Switching

- *What we've done*

  Reviewed technical literature of optical switches.

  Performed experiments with applications involving optical switching devices.

- *What we're planning to do*

  Investigate clock recovery devices.

  Research space switches.

  Investigate optical switch applications in all-optical networks.

Modeling and Measurements

- *What we've done*
  - *Developed high fidelity model for fiber transport*
  - *Applied model to address WDM over DSF issues raised by Sprint*
  - *Model has also been used by Sprint's Network Planning group*
- *What we're planning to do*
  - *Use this capability to address network issues*

PMD Compensation

- *What we've done*
  - *Investigate PMD compensation schemes*
- *What we're planning to do*
  - *Develop an improved PMD compensator*

Future Efforts

- Continue development of lightwave system model
- "Virtual transport networks"
  - optical and information transparency
  - survivability
- Bidirectional networks
- Continued hardware development of dispersion managed and soliton systems
- Explore optical switching technologies and all-optical clock recovery techniques