Kokyo
株式会社 光響
Email : info@symphotony.com
Web : https://www.symphotony.com/

CodeSScientific

OCSim Modules 2018 version 2.0

Fiber Optic Communication System Simulations Software Modules with Matlab

Use the Existing Modules for Research Papers, Research Projects and Theses

Modify the Modules to the Next Level for Research Papers, Research Projects and Theses

Integrate the Different Modules to Realize Your Own Fiber Optic Communication Systems

Use the Existing Modules for Teaching, Laboratory Simulation Experiments, Exercises and Projects

Modify the Modules for Co-Simulations with the Third Party Commercial Optical Communication System Softwares

OCSim Modules

OCSim software modules are the most popular products for the design and simulation of modern and advanced level fiber optic communication systems. **OCSim** modules have been proven to provide accurate simulations. The modules which are continuously upgraded are in use for the **last fourteen years** for simulating fiber optic communication systems, publishing research papers, theses and laboratory simulation experiments.

Modules (1 to 17) in the Package

OCSim (2014-15).a

Module 1 : Electromagnetic Waves
Module 2 : Optical Fibers
Module 3 : Lasers
Module 4 : Modulation Schemes
Module 5 : Optical Receivers
Module 6 : Optical Amplifiers
Module 7 : Fiber Optic Transmission System Design
Module 8 : Performance Analysis
Module 9 : Channel Multiplexing Techniques
Module 10 : Nonlinear Fiber Optics
Module 11 : Digital Signal Processing

OCSim 2016.a

Module 12 : Optical PAM-M Modulators & Transmitters

OCSim Modules

Modules in the Package (contd.)

OCSim 2016.b

Module 13 : Long Haul QPSK Fiber Optic Coherent Communication Systems

OCSim 2016.c

Module 14 : Dual Polarization QAM-M CO-OFDM Systems

OCSim 2017.a

Module 15: Long Haul QAM-16 Fiber Optic Coherent Communication Systems

OCSim 2018.a

Module 16: Long Haul Polarization Multiplexed (PM) QAM-M Fiber Optic Coherent Communication Systems

OCSim 2018.b

Module 17: Long Haul *WDM* Polarization Multiplexed (PM) QAM-M Fiber Optic Coherent Communication Systems

Benefits

- Advanced Level Software Modules with Matlab
- Manuals with Well Explained Related Theory, Formulas and Descriptions
- Use the Existing Modules for Research Papers, Research Projects and Theses
- Modify the Modules to the Next Level for Research Papers, Research Projects and Theses
- Integrate the Different Modules to Realize Your Own Fiber Optic Communication Systems
- Use the Existing Modules for Teaching, Laboratory Simulation Experiments, Exercises and Projects
- Modify the Modules for Co-Simulations with the Third Party Commercial Optical Communication System Softwares

Applications

- Propagation of Rectangular Waves
- Propagation of Cosine Waves
- Simulation of Standing Waves
- Fiber Modes in Optical Fibers
- Fiber Dispersion in Optical Fibers
- Optical Field Envelope / Total Field Propagation in Optical Fibers
- EDFA Gains in Fibers using Nonlinear Differential Equations
- Raman Gains in Fibers using Nonlinear Differential Equations
- Nonlinear Pulse Propagation in Optical Fibers
- Carrier Density and Optical Power of Laser Diodes for DC Currents
- Carrier Density and Optical Power of Laser Diodes for Pulsed Currents
- Shot Noise, Thermal Noise and SNR of PIN and APD Receivers
- Error Probability Calculations of OOK, PSK data for Homodyne Receivers
- Error Probability Calculations of OOK, PSK, FSK data for Heterodyne Receivers
- Error Probability Calculations of OOK, FSK and DPSK data for Direct Detection Receivers
- NRZ-OOK Optical Modulators and Transmitters
- NRZ-PSK Optical Modulators and Transmitters
- NRZ-QPSK Optical Modulators and Transmitters
- QPSK- Nyquist Optical Modulators and Transmitters

Applications (contd.)

- Fiber Optic **Long Haul** Dispersion Managed Intensity Modulated Direct Detection Systems – Linear & Nonlinear
- Fiber Optic **Long Haul WDM** Dispersion Managed Direct Detection Systems – Linear & Nonlinear
- Fiber Optic SINGLE Polarization QAM-M CO-OFDM Systems – Linear & Nonlinear
- Fiber Optic DUAL Polarization QAM-M CO-OFDM Systems – Linear & Nonlinear
- Fiber Optic Coherent QPSK Systems with Laser Phase Noise Compensation through Digital Signal Processing (DSP)
- Fiber Optic Coherent QPSK Systems with Chromatic Dispersion Compensation through Digital Signal Processing (DSP)
- Fiber Optic **Long Haul** Coherent QPSK Systems with Chromatic Dispersion and SPM Compensations through Digital Signal Processing (DSP)
- Fiber Optic **Long Haul** QAM-16 Coherent Communication Systems
- Fiber Optic **Long Haul** Polarization Multiplexed (PM) QAM-M Coherent Communication Systems
- Fiber Optic **Long Haul WDM** Polarization Multiplexed (PM) QAM-M Coherent Communication Systems
- Optical PAM-M Modulators and Transmitters for High Bandwidth Networks and Data Centres

Follow the Expert

We have been using the Fiber Optic Communication Systems Software Modules for the last **14 years** for publishing research papers, theses and laboratory simulation experiments. In these modules, the underlying complex theories and equations of fiber optic communication systems have been converted into Matlab programs giving the insight into the concepts involved and more understanding of the subject. Starting from the first principles, academicians, engineers and researchers in universities and companies can go up to the most modern fiber optic communication systems including the latest analog and digital modulation techniques like BPSK, QPSK, DP-QPSK, DP-QAM-M, PM-QAM-M, QAM-16 and PAM-M.

Professor Shiva Kumar,
Electrical and Computer Engineering Department,
McMaster University, Canada,
and
The author of the book,
"Fiber Optic Communications: Fundamentals and Applications" John Wiley and Sons, 2014

Licensing Features

Module Types: Software Modules with Matlab (**.**m files)

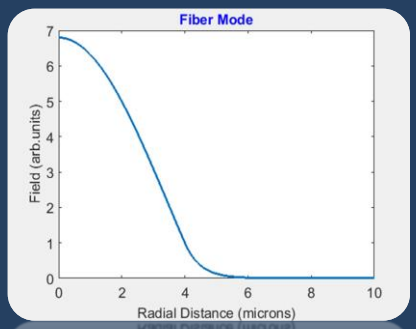
- Commercial Perpetual Licenses for Research Labs / Companies
- Academic Perpetual Research Licenses for Universities
- Multiple Perpetual Teaching Licenses for Universities
- Manuals with Well Explained Related Theory, Formulas and Descriptions
- Multiyear Scientific, Theoretical and Programing Support on the Existing OCSim Modules
- Option to Collaborate with CodeSScientific Researchers on the Existing OCSim Modules
- R&D Services for Customization / Integration of Source Code Modules to Your Company's Products

With the Purchase of the Modules - Full discount on a reference book for fundamental concepts:

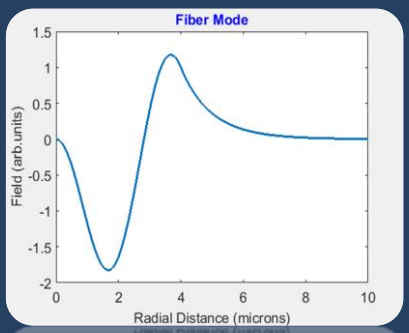
Fiber Optic Communications: Fundamentals and Applications: Shiva Kumar (McMaster Univ. Canada), and M. Jamal Deen (McMaster Uni. Canada), John Wiley & Sons, 2014.

Selected Simulated Results

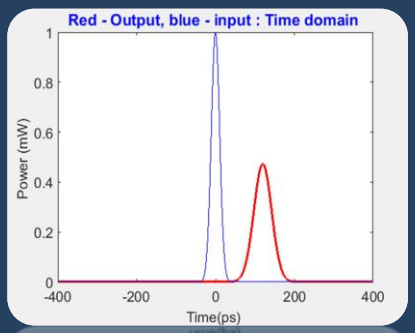
Optical Fiber Modes



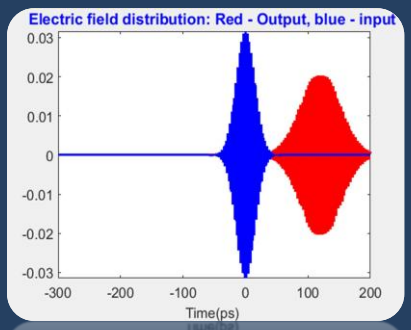
Optical Fiber Modes



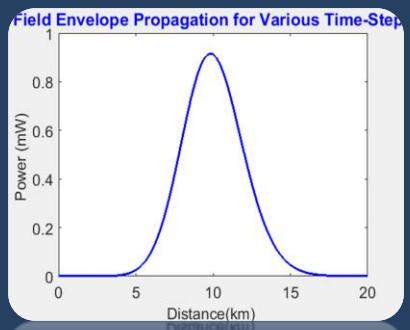
Optical Fiber Dispersion



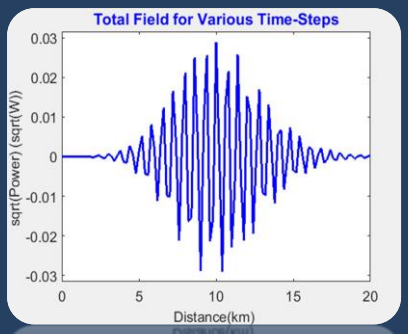
Optical Fiber Dispersion



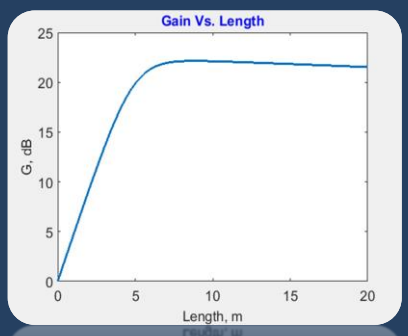
Field Envelop Propagation in Optical Fibers



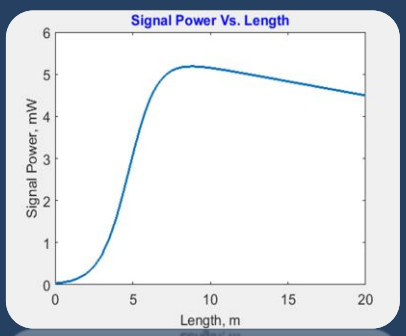
Total Field Propagation in Optical Fibers



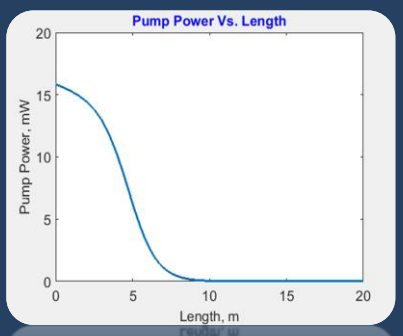
EDFA Gains in Optical Fibers



EDFA Gains in Optical Fibers

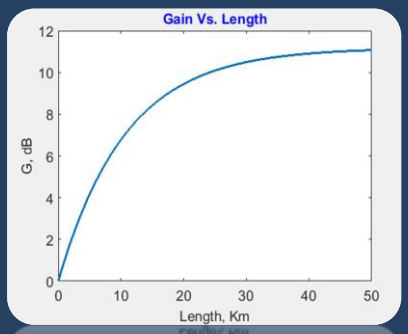


EDFA Gains in Optical Fibers

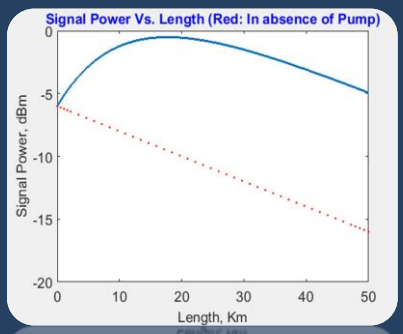


Selected Simulated Results

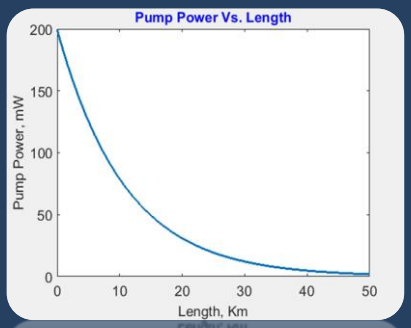
Raman Gains in Optical Fibers



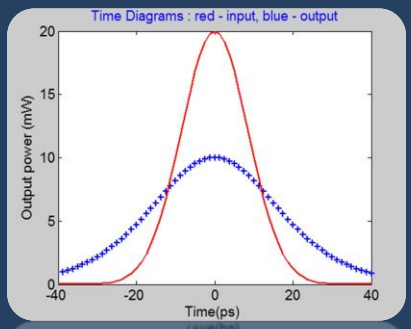
Raman Gains in Optical Fibers



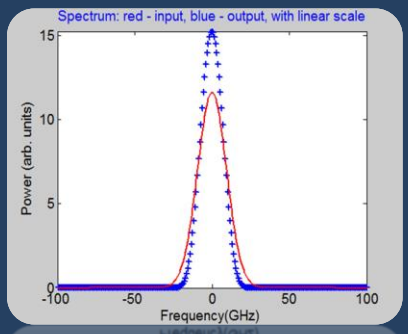
Raman Gains in Optical Fibers



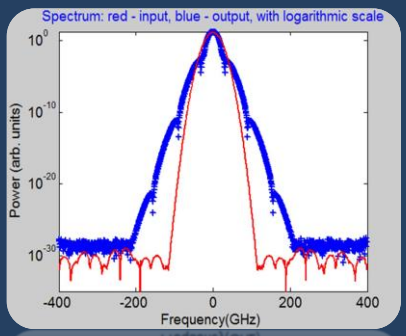
Nonlinear Pulse Propagation in Optical Fibers



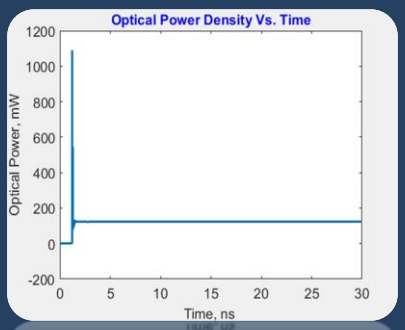
Nonlinear Pulse Propagation in Optical Fibers



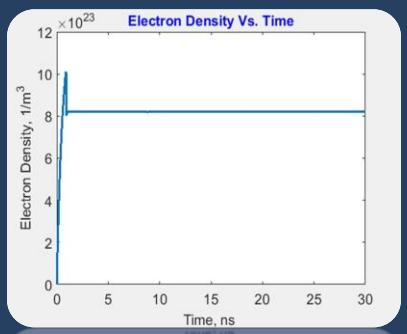
Nonlinear Pulse Propagation in Optical Fibers



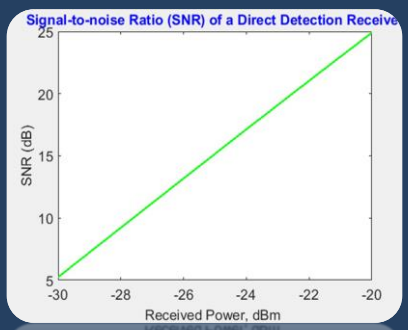
Laser Diodes for DC and Pulsed Currents



Laser Diodes for DC and Pulsed Currents

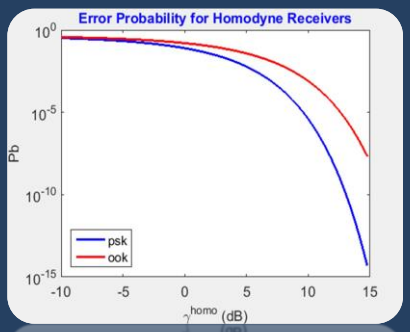


Optical Receivers

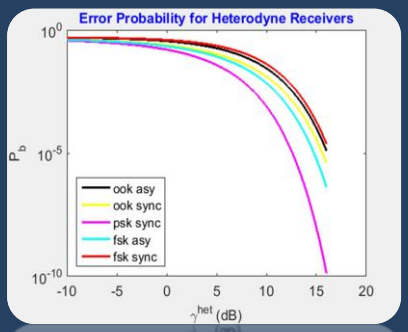


Selected Simulated Results

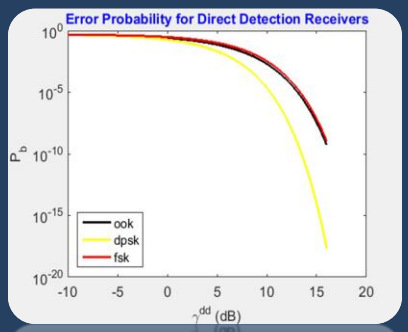
Optical Homodyne Receivers



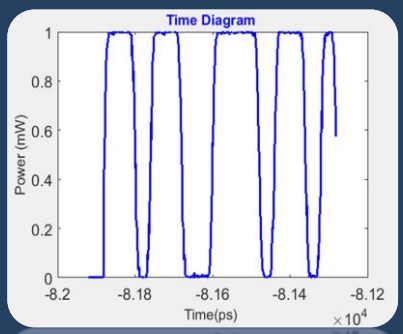
Optical Heterodyne Receivers



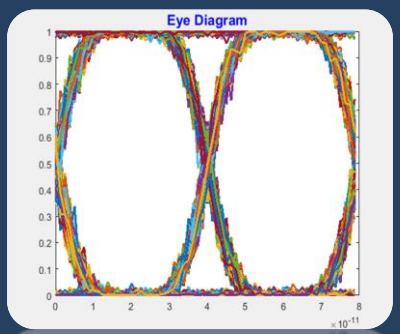
Optical Direct Detection Receivers



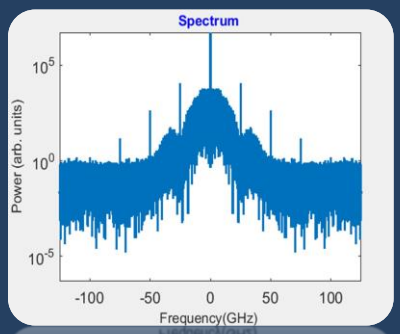
NRZ-OOK Optical Modulators and Transmitters



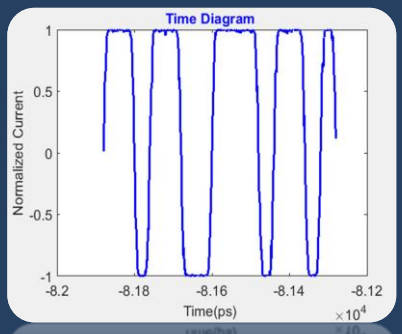
NRZ-OOK Optical Modulators and Transmitters



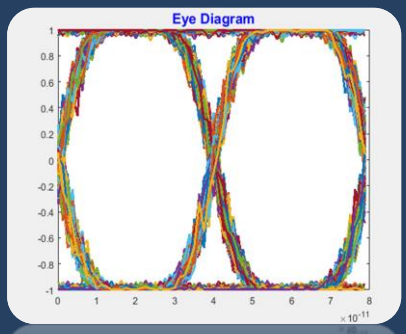
NRZ-OOK Optical Modulators and Transmitters



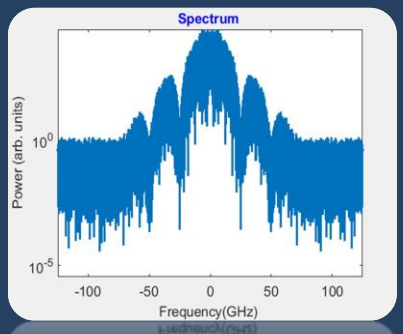
NRZ-PSK Optical Modulators and Transmitters



NRZ-PSK Optical Modulators and Transmitters

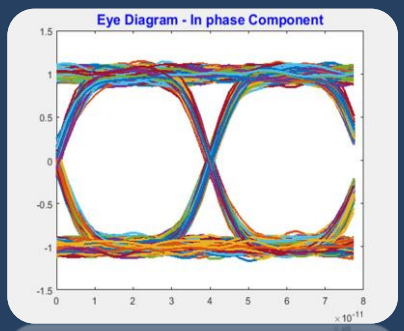


NRZ-PSK Optical Modulators and Transmitters

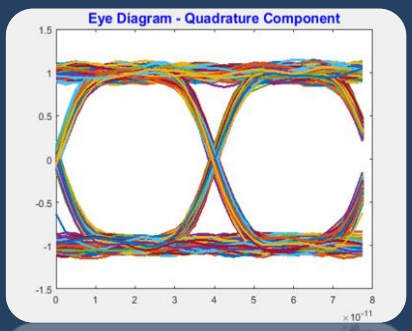


Selected Simulated Results

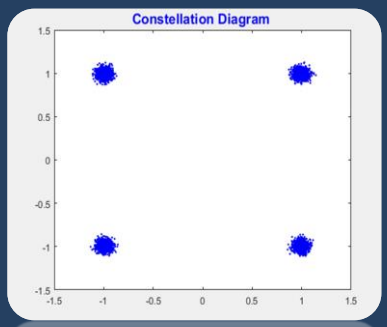
NRZ-QPSK Optical Modulators and Transmitters



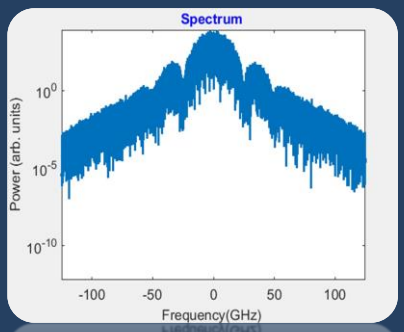
NRZ-QPSK Optical Modulators and Transmitters



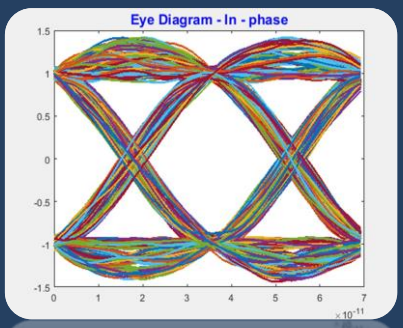
NRZ-QPSK Optical Modulators and Transmitters



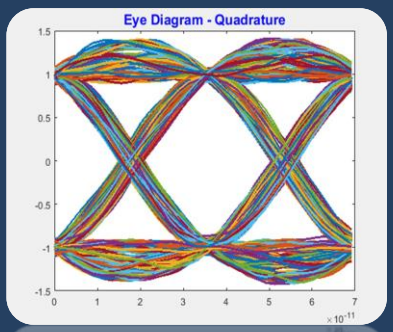
NRZ-QPSK Optical Modulators and Transmitters



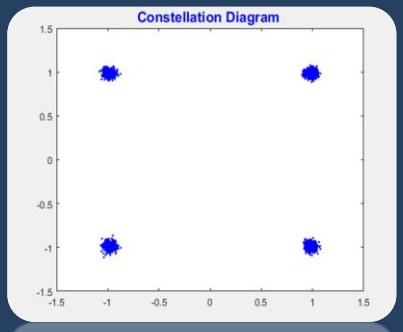
QPSK- Nyquist Optical Modulators and Transmitters



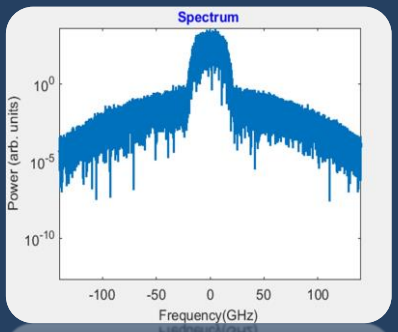
QPSK- Nyquist Optical Modulators and Transmitters



QPSK- Nyquist Optical Modulators and Transmitters

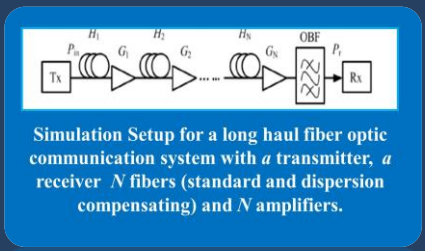


QPSK- Nyquist Optical Modulators and Transmitters



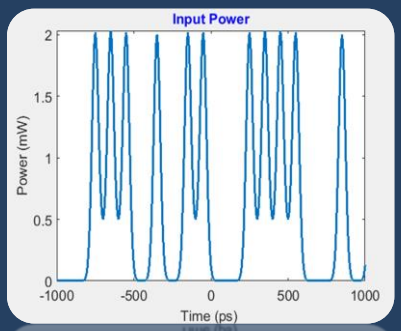
Selected Simulated Results

Fiber Optic Intensity Modulated Direct Detection Systems
Linear and Nonlinear

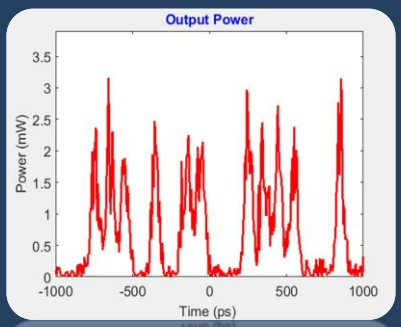


Simulation Setup for a long haul fiber optic communication system with *a* transmitter, *a* receiver *N* fibers (standard and dispersion compensating) and *N* amplifiers.

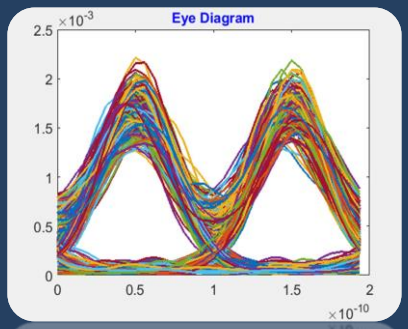
Fiber Optic Intensity Modulated Direct Detection Systems
Linear and Nonlinear



Fiber Optic Intensity Modulated Direct Detection Systems
Linear and Nonlinear

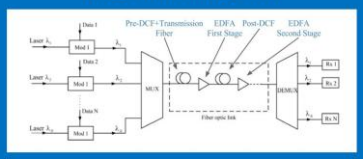


Fiber Optic Intensity Modulated Direct Detection Systems
Linear and Nonlinear

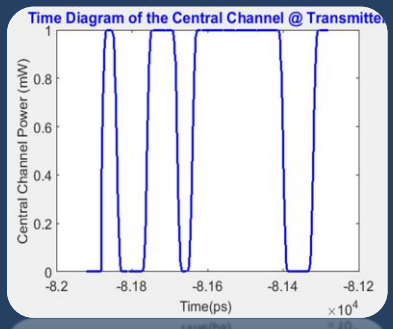


Fiber Optic WDM Direct Detection Systems
Linear and Nonlinear

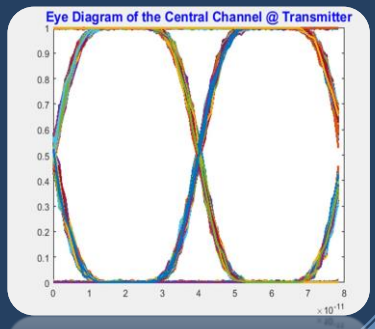
Simulation Setup for a Fiber Optic WDM Direct Detection System



Fiber Optic WDM Direct Detection Systems
Linear and Nonlinear

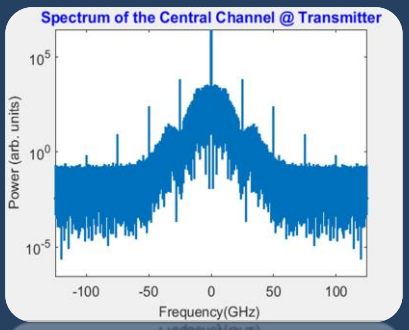


Fiber Optic WDM Direct Detection Systems
Linear and Nonlinear

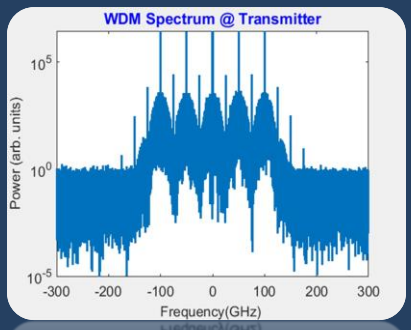


Selected Simulated Results

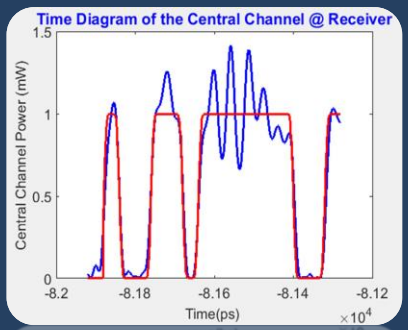
Fiber Optic WDM
Direct Detection Systems
Linear and Nonlinear



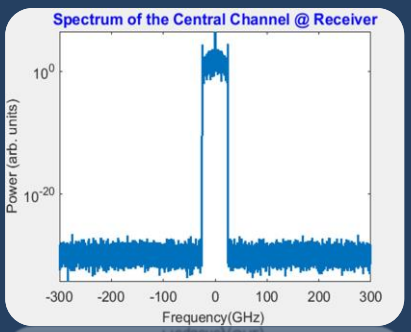
Fiber Optic WDM
Direct Detection Systems
Linear and Nonlinear



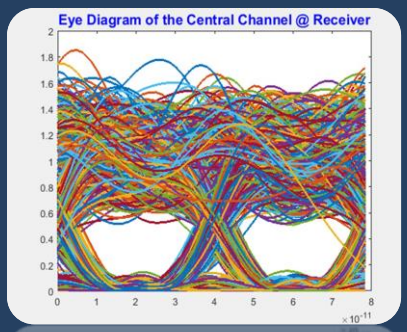
Fiber Optic WDM
Direct Detection Systems
Linear and Nonlinear



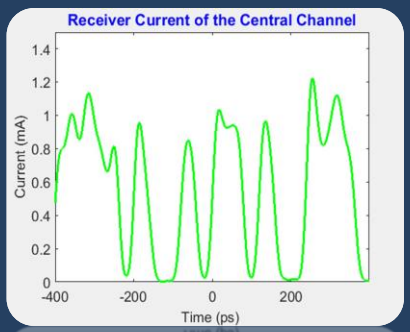
Fiber Optic WDM
Direct Detection Systems
Linear and Nonlinear



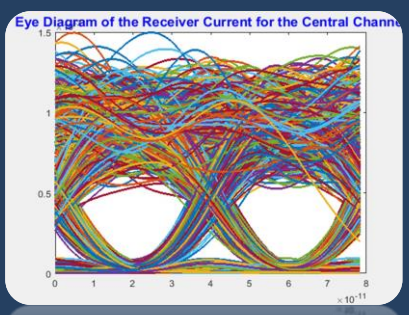
Fiber Optic WDM
Direct Detection Systems
Linear and Nonlinear



Fiber Optic WDM
Direct Detection Systems
Linear and Nonlinear

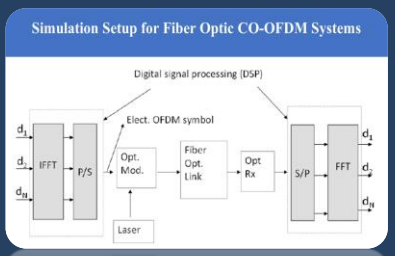


Fiber Optic WDM
Direct Detection Systems
Linear and Nonlinear

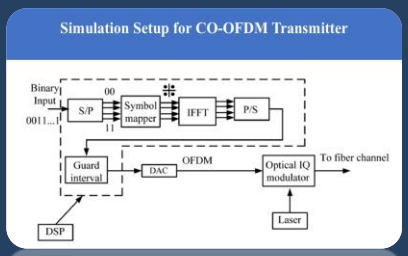


Selected Simulated Results

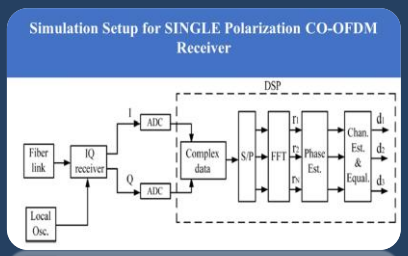
Fiber Optic SINGLE Polarization
QAM-M CO-OFDM Systems
Linear and Nonlinear



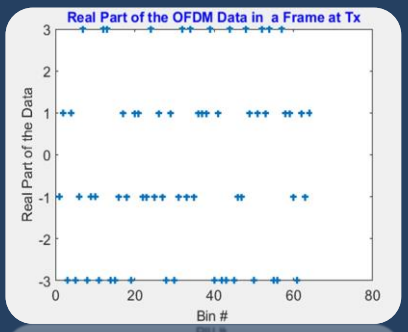
Fiber Optic SINGLE Polarization
QAM-M CO-OFDM Systems
Linear and Nonlinear



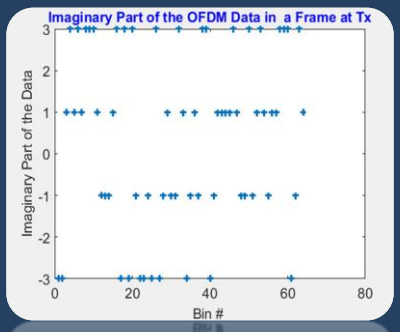
Fiber Optic SINGLE Polarization
QAM-M CO-OFDM Systems
Linear and Nonlinear



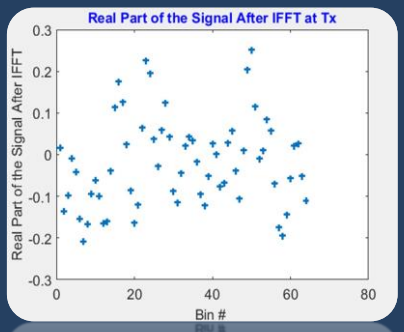
Fiber Optic SINGLE Polarization
QAM-M CO-OFDM Systems
Linear and Nonlinear



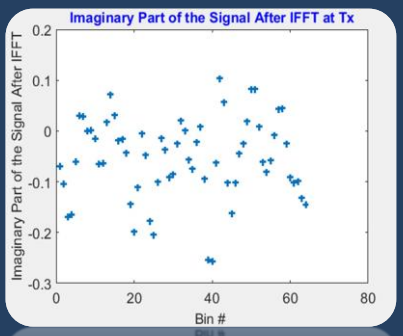
Fiber Optic SINGLE Polarization
QAM-M CO-OFDM Systems
Linear and Nonlinear



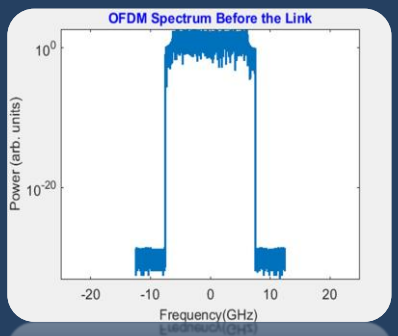
Fiber Optic SINGLE Polarization
QAM-M CO-OFDM Systems
Linear and Nonlinear



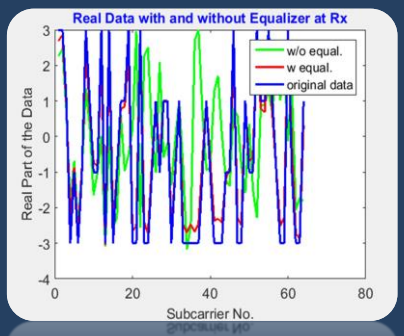
Fiber Optic SINGLE Polarization
QAM-M CO-OFDM Systems
Linear and Nonlinear



Fiber Optic SINGLE Polarization
QAM-M CO-OFDM Systems
Linear and Nonlinear

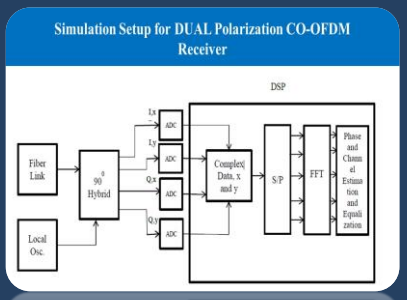


Fiber Optic SINGLE Polarization
QAM-M CO-OFDM Systems
Linear and Nonlinear

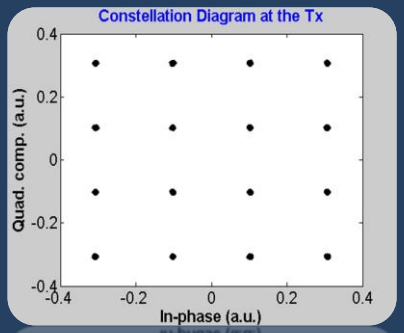


Selected Simulated Results

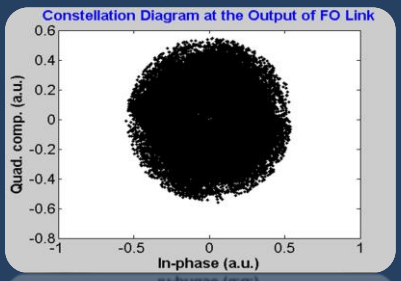
Fiber Optic DUAL Polarization QAM-M CO-OFDM Systems
Linear and Nonlinear



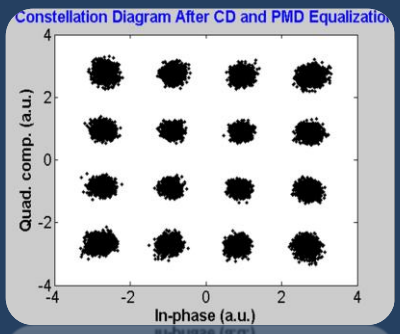
Fiber Optic DUAL Polarization QAM-M CO-OFDM Systems
Linear and Nonlinear



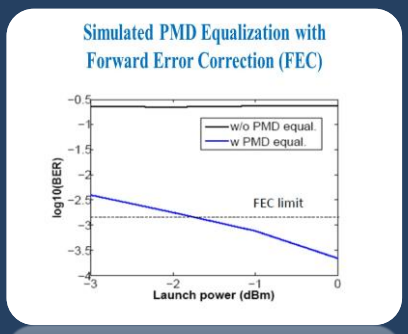
Fiber Optic DUAL Polarization QAM-M CO-OFDM Systems
Linear and Nonlinear



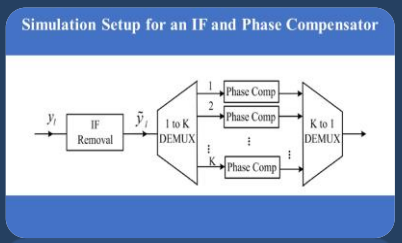
Fiber Optic DUAL Polarization QAM-M CO-OFDM Systems
Linear and Nonlinear



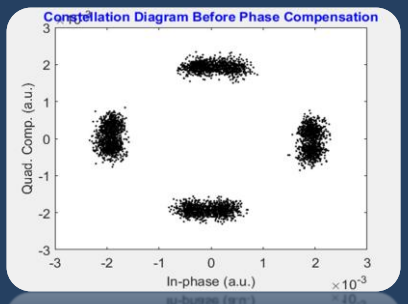
Fiber Optic DUAL Polarization QAM-M CO-OFDM Systems
Linear and Nonlinear



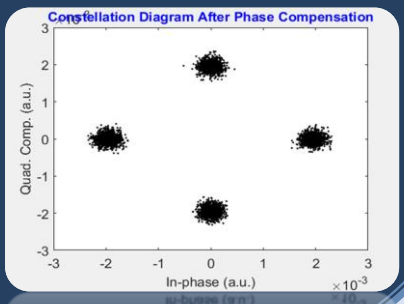
Fiber Optic Coherent QPSK Systems with *Laser Phase Noise Compensation*



Fiber Optic Coherent QPSK Systems with *Laser Phase Noise Compensation*

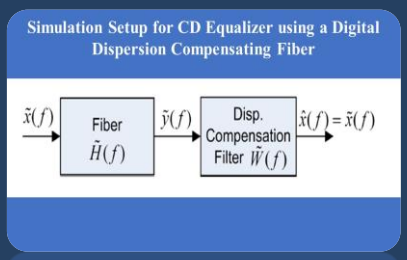


Fiber Optic Coherent QPSK Systems with *Laser Phase Noise Compensation*

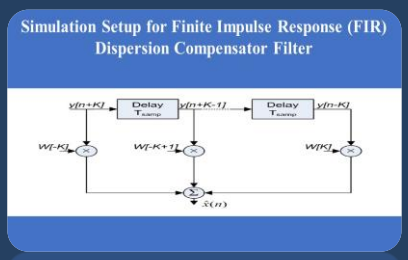


Selected Simulated Results

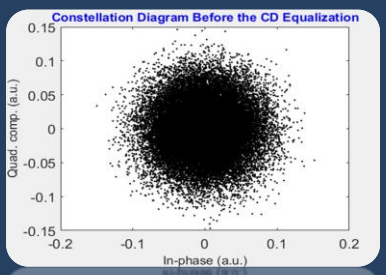
Fiber Optic Coherent QPSK Systems with *Chromatic Dispersion Compensation*



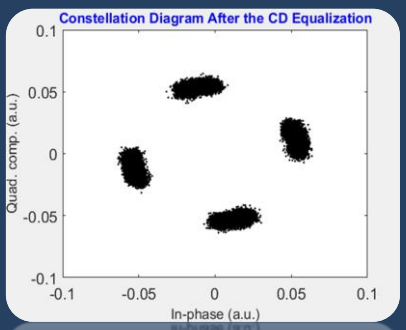
Fiber Optic Coherent QPSK Systems with *Chromatic Dispersion Compensation*



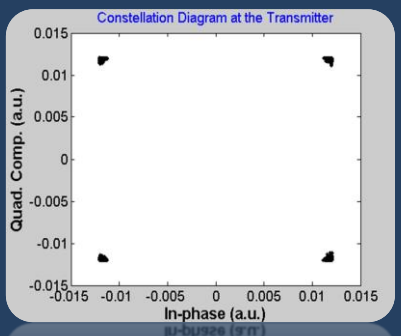
Fiber Optic Coherent QPSK Systems with *Chromatic Dispersion Compensation*



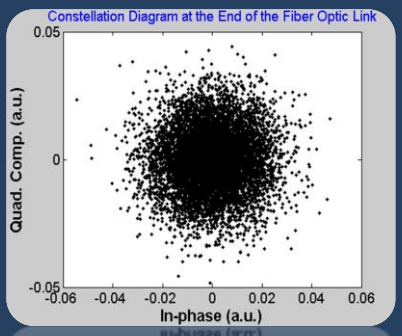
Fiber Optic Coherent QPSK Systems with *Chromatic Dispersion Compensation*



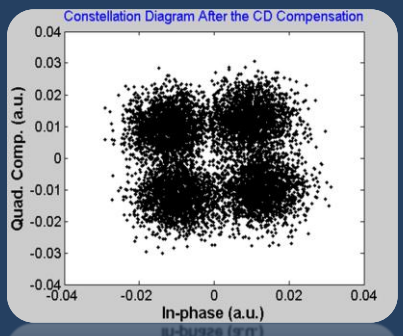
Fiber Optic Long Haul Coherent QPSK Systems



Fiber Optic Long Haul Coherent QPSK Systems

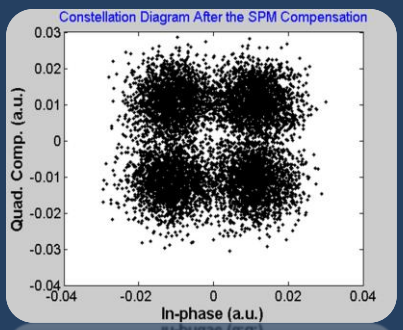


Fiber Optic Long Haul Coherent QPSK Systems



Selected Simulated Results

Fiber Optic Long Haul Coherent QPSK Systems



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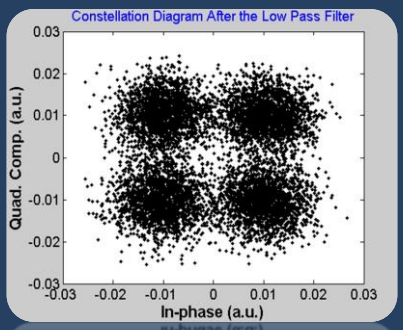
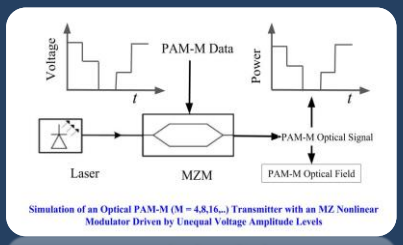
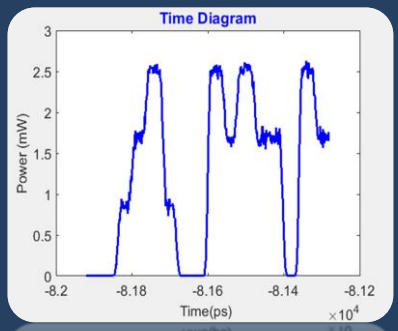


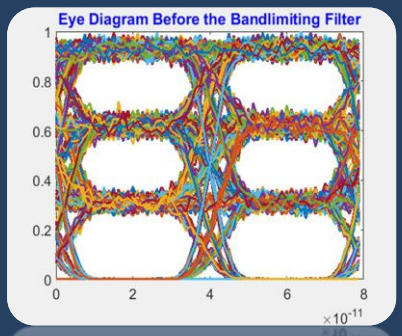
Optical PAM-M Transmitters for Data Centres



Optical PAM-M Transmitters for Data Centres



Optical PAM-M Transmitters for Data Centres



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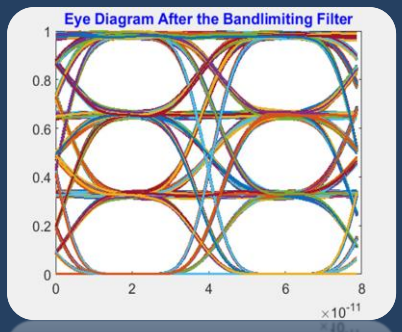

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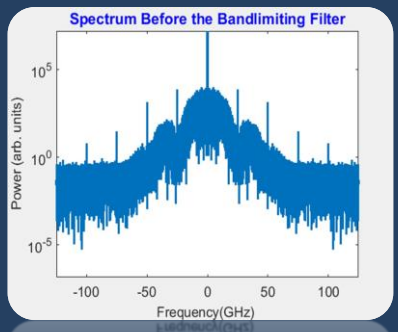

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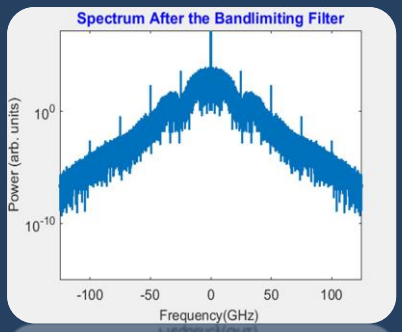
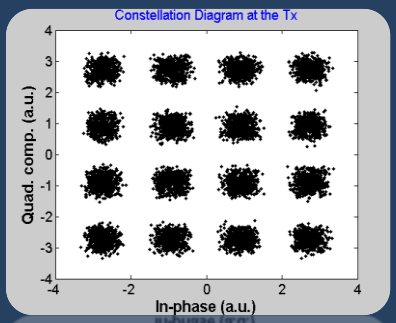
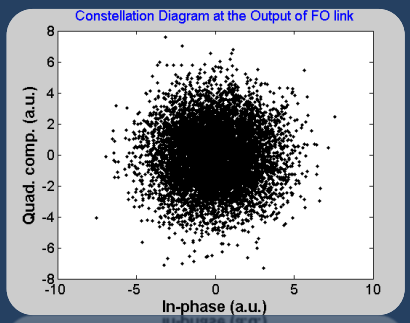


Selected Simulated Results

Fiber Optic Long Haul QAM-16 Coherent Communication Systems



Fiber Optic Long Haul QAM-16 Coherent Communication Systems



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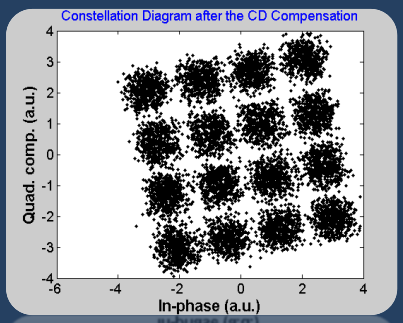
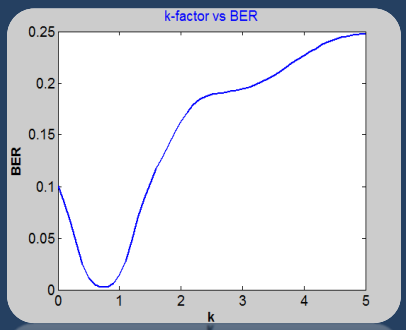
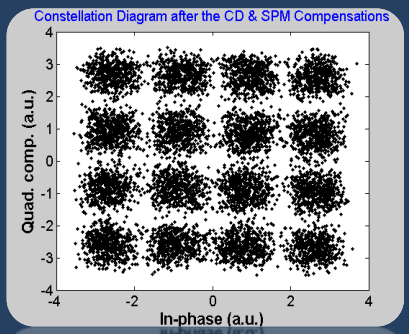


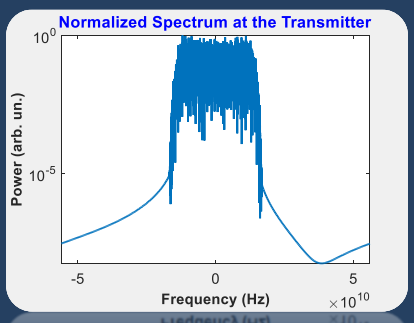
Fiber Optic Long Haul QAM-16 Coherent Communication Systems



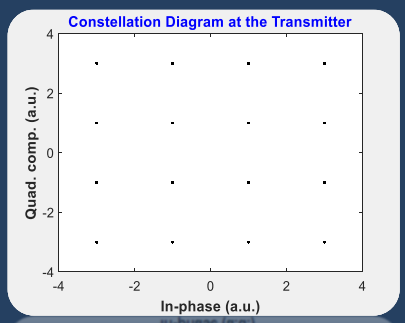
Fiber Optic Long Haul QAM-16 Coherent Communication Systems



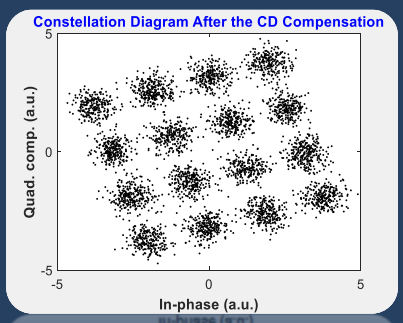
Fiber Optic Long Haul Polarization Multiplexed (PM) QAM-M Coherent Communication Systems



Fiber Optic Long Haul Polarization Multiplexed (PM) QAM-M Coherent Communication Systems

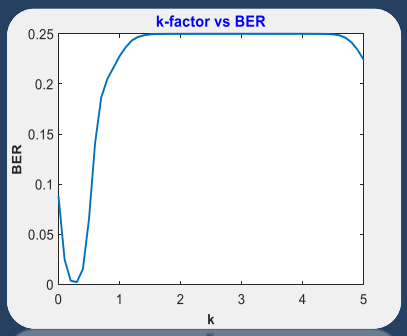


Fiber Optic Long Haul Polarizati Multiplexed (PM) QAM-M Coher Communication Systems

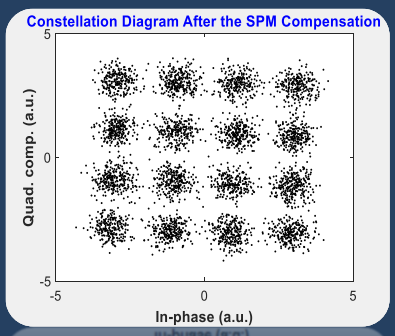


Selected Simulated Results

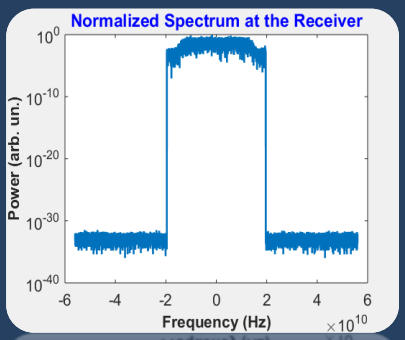
Fiber Optic Long Haul Polarization Multiplexed (PM) QAM-M Coherent Communication Systems



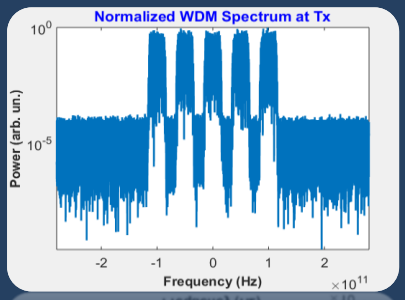
Fiber Optic Long Haul Polarization Multiplexed (PM) QAM-M Coherent Communication Systems



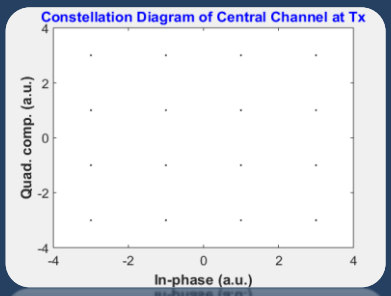
Fiber Optic Long Haul Polarizatio Multiplexed (PM) QAM-M Cohere Communication Systems



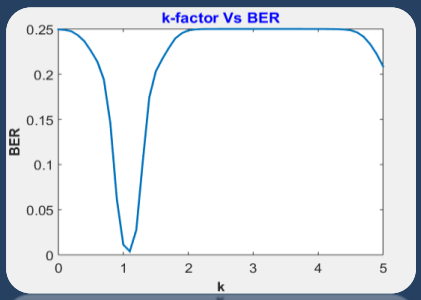
Fiber Optic Long Haul *WDM* Polarization Multiplexed (PM) QAM-M Coherent Communication Systems



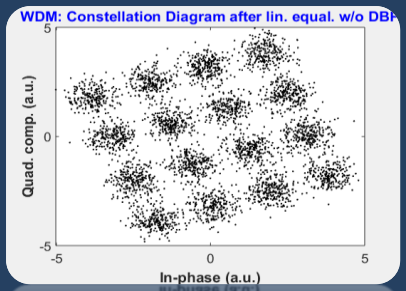
Fiber Optic Long Haul *WDM* Polarization Multiplexed (PM) QAM-M Coherent Communication Systems



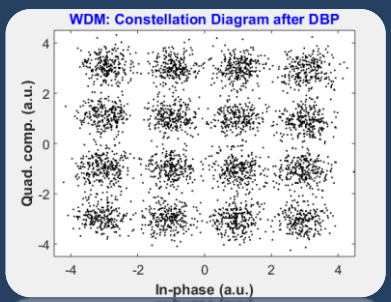
Fiber Optic Long Haul *WDM* Polarization Multiplexed (PM) QAM-M Coherent Communicatio Systems



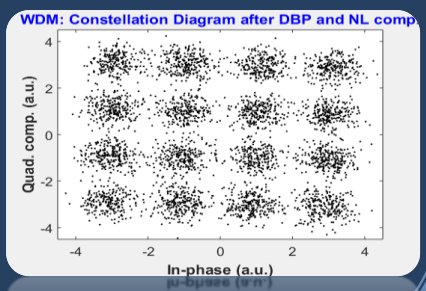
Fiber Optic Long Haul *WDM* Polarization Multiplexed (PM) QAM-M Coherent Communication Systems



Fiber Optic Long Haul *WDM* Polarization Multiplexed (PM) QAM-M Coherent Communication Systems

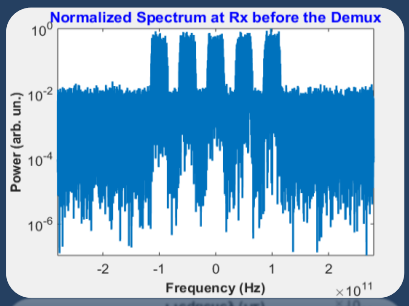


Fiber Optic Long Haul *WDM* Polarization Multiplexed (PM) QAM-M Coherent Communicatio Systems

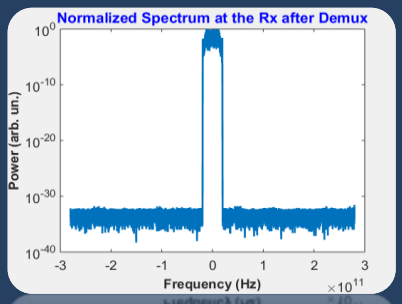


Selected Simulated Results

Fiber Optic Long Haul *WDM* Polarization Multiplexed (PM) QAM-M Coherent Communication Systems



Fiber Optic Long Haul *WDM* Polarization Multiplexed (PM) QAM-M Coherent Communication Systems



Following Fiber Optic Communication Systems can be designed

- **Long Haul *WDM* Polarization Multiplexed (PM) QAM-M Fiber Optic Coherent Communication Systems**
- **Long Haul Polarization Multiplexed (PM) QAM-M Fiber Optic Coherent Communication Systems**
- **Long Haul QAM-16 Fiber Optic Coherent Communication Systems**
- **Single Polarization QAM-M CO-OFDM Fiber Optic Communication Systems**

  10 Gb/s, 512 subcarrier, 40 span QAM-M CO-OFDM fiber optic systems

  25 Gb/s, 1024 subcarrier, 20 span QAM-M CO-OFDM fiber optic systems

  40 Gb/s, 2048 subcarrier, 10 span QAM-M CO-OFDM fiber optic systems

  n Gb/s, *m* subcarrier, *N* span QAM-M CO-OFDM fiber optic systems

  Choose the desired values of *n, m* and *N* for simulations.

  Simulate more:

  Choose the value of M in QAM-M to simulate special cases, e.g., M = 2 for BPSK and M = 4 for QPSK and M = 8, 16, and so on for higher order QAM.

  Switch on to *nonlinearity* to design and simulate *nonlinear* QAM-M CO-OFDM fiber optic systems.

- **Dual Polarization QAM-M CO-OFDM Fiber Optic Communication Systems**

  This module takes into account (1) Dispersion, (2) Nonlinearity, (3) PMD and (4) Random coupling between polarizations in the fibers.

- **Long Haul QPSK Fiber Optic Coherent Communication Systems with Digital Signal Processing**

  28 GBaud, 20 span coherent QPSK fiber optic systems

  10 GBaud, 60 span coherent QPSK fiber optic systems

  28 GBaud, 20 span Nyquist pulse coherent QPSK fiber optic systems

  10 GBaud, 60 span Nyquist pulse coherent QPSK fiber optic systems

  n GBaud, *N* span coherent QPSK fiber optic systems

  n GBaud, *N* span Nyquist pulse coherent QPSK fiber optic systems

  Choose the desired values of *n* and *N* for simulations.

  Simulate more:

  Compensate Laser Phase Noise, Chromatic Dispersion and *SPM* through Digital Signal Processing in coherent QPSK fiber optic systems.

  Modify to coherent DP-QPSK fiber optic system. Scientific and Programing support is available for modifying to coherent DP-QPSK fiber optic system.

- **Long Haul *WDM* Dispersion Managed Direct Detection Fiber Optic Communication Systems**

  28 Gb/s/channel, 50 GHz channel spacing, 8 channel, 20 span WDM fiber optic systems

  10 Gb/s/channel, 25 GHz channel spacing, 16 channel, 40 span WDM fiber optic systems

  40 Gb/s/channel, 100 GHz channel spacing, 8 channel, 20 span WDM fiber optic systems

  n Gb/s/channel, *m* GHz channel spacing, *M* channel, *N* span WDM fiber optic systems

  Choose the desired values of *n, m, M* and *N* for simulations.

  Simulate more:

  Switch on to *nonlinearity* to design and simulate nonlinear WDM fiber optic systems.

- **Long Haul Dispersion Managed Intensity Modulated Direct Detection (IMDD) Fiber Optic Communication Systems**

  10 Gb/s, 40 span IMDD fiber optic systems

  28 Gb/s, 20 span IMDD fiber optic systems with inline dispersion compensation

  40 Gb/s, 20 span IMDD fiber optic systems with inline dispersion compensation

  40 Gb/s, 20 span IMDD fiber optic systems with dispersion managed fibers

  n Gb/s, *N* span IMDD fiber optic systems

  Choose the desired values of *n* and *N* for simulations.

  Simulate more:

  Switch on to *nonlinearity* to design and simulate nonlinear IMDD fiber optic systems.

CodeSScientific

118 Bufflehead Way
Ottawa, Ontario / K1T0G3
Canada
Tel.: 1 (613) 325-7594
Email: sales@codesscientific.com
Web: www.codesscientific.com

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