VPI Photonics

Applications and projects

ParsOptics.com

+---**Access & Aggregation**
| +---**Digital SCM**
| | | 16-QAM over 10km SMF - EVM vs optical Power
| | | 256-QAM over RF Channel
| | | 4 WDM each with Thirty 30 MBps QAM
| | | 5 Channel QAM Tx, galaxy
| | | 5x2.5Gbps SCM over Optical SSB
| | | 64-QAM and 77 Analog SNR
| | | 64-QAM over Optical Channel
| | | 64-QAM RX Phase
| | | Bidirectional UMTS over Fiber
| | | Laser Clipping Impulse Noise
| | | M-QAM - EVM vs electrical SNR
| | | mQAM Symbol Error Rate Estimation
| | | Multimode Fiber - QAM Subcarrier Response
| | | Upstream with Frequency Stacking
| | | XPM Crosstalk from non-ideal Demultiplexer
| | | XPM Optical Crosstalk
| | |
| +---**Hybrid Systems**
| | | 70 NTSC plus Thirty 30 Mbps QAM
| | | 70 NTSC plus Two 30 Mbps QAM
| | | BER and Dynamic Range
| | | FTTH with Distribution
| | | FTTH with Multipath
| | | Noise Power Ratio Test - Digital Return
| | | Nonlinear Distortions in RoF Systems
| | | QAM with 256 Mbps Baseband
| | | Upstream with Baseband Digital Return
| |
| +---**O-CDMA**
| | | OCDMA using Phase Encoding
| | | OCDMA with 7-Chip SSFBG Encoder - Design
| | | OCDMA with 7-Chip SSFBG Encoder - Performance
| | | OF CDMA - Passive Correlation Detection with DOHL
| |
| +---**PON**
| | | 10 Gb Ethernet PON
| | | 10GPON Mask Analysis
| | | 50Gbps Downstream PON for 64 Users
| | | ASK-ASK Configuration for RSOA-based WDM-PONs
| | | Colorless ONU Using Reflective SOA

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|   |       Extended PON SOA
|   |       OFDM for Optical Access
|   |       PON Transceiver Characterization
|   |       Rayleigh Backscattering in Reflective ONU with RSOA
|   |       Survivable AWG-based WDM-PON
|   |       WDM-PON based on Spectrum Slicing
|   |
|   \---WDM
|           CWDM with Amplifier ASExASE
|           CWDM with Amplifier BER Curves
|           Mixed Services Metro
|           Spectrum-Sliced WDM System
|
+---Amplifier Dynamics
|       Electronically Gain-Clamped EDFA
|       Optically Gain-Clamped EDFA
|       Single EDFA Power Dynamics
|
+---Amplifier Modeling
|   +---Black Box Model
|   |       Black Box vs. EDFA 1480nm
|   |       BlackBox vs. EDFA 980nm
|   |       Convert to Black-Box
|   |       Verify Black-Box
|   |
|   +---DopedFiber
|   |       Amplifiers - Getting Started
|   |       Concentration Quenching
|   |       DopedFiber - Design Issues
|   |       DopedFiber - Rayleigh Backscatter Issues
|   |       DopedFiber_FWM
|   |       EDF Net Gain vs. Inversion
|   |       Excited State Absorption
|   |       Spectral Hole Burning
|   |       Temperature Dependence
|   |
|   \---EDWA
|           EDWA - Full Approach vs. Effective Overlap
|           EDWA - Index Profile vs. Refractive Index
|
+---Analog Systems
|   +---CATV
|   |       20 Channel NTSC CSO CTB IMD
|   |       80 Channel NTSC CSO CTB IMD
|   |       97 Channel PAL CSO & CTB
|   |       Amplifier Noise to CNR
|   |       BFR90 Laser Driver
|   |       Chirped DM Laser IMD
|   |       Chirped MZ IMD
|   |       CSO Fiber Dispersion Compensation
|   |       Data Sheet Laser Model
|   |       Dynamic and Adiabatic Chirp
|   |       Dynamic Clipping Distortion CTB
|   |       Dynamic Clipping Distortion
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|   |       EA Dynamic Chirp IMD
|   |       mm-Wave with Photonic Upconversion
|   |       Multipath Emulator in System
|   |       Multipath System with YAG Laser
|   |       MZ Clipping Distortion
|   |       MZ Predistorted 80ch System
|   |       MZ Predistortion Linearity Test
|   |       MZ Two-Tone Intermodulation Distortion
|   |       NTSC system CNR
|   |       Parasitic Fabry-Perot Model
|   |       Rayleigh Backscatter with Optical Amplifier
|   |       Two-Tone Intermodulation Distortion
|   |
|   \---RF over Fiber
|           3rd Order Intercept
|           5G Wireless Back Haul
|           Chirped MZ Frequency Response
|           Chirpless MZ Frequency Response
|           Distortion vs Length
|           Fiber Link Distortion
|           Fiber Link Noise
|           Filter Induced Distortion
|           Frequency & Phase Response
|           Frequency Response with Filter
|           Frequency Response
|           Microwave Signal Generation
|           MZ Frequency Response
|           Notch Filter using Dispersive Fiber
|           Notch Filter using MZI Real Laser
|           Optical Feedforward Linearizer
|           Optical Signal Generation with OPLL
|           Photonic Mixer
|           Push-Pull Analog Transmission
|           ROF System
|           Serrodyne Comb Generation
|           Storage Ring
|
+---Characterization
|   +---Brillouin Scattering
|   |       Rayleigh & Brillouin Scattering In BiDir WDM System
|   |       SBS Eye Opening Penalty
|   |       SBS Suppression
|   |       SBS Threshold
|   |
|   +---Dispersion & Kerr
|   |       50Gbps RZ-DQPSK - CD Tolerance
|   |       All-Optical Wavelength Converter OPC
|   |       CD Penalty Measurement
|   |       Commercial Few Mode Fibers
|   |       Cross Mode Modulation
|   |       Differential Mode Delay and Coupling in MMF
|   |       Digital Back Propagation (DBP) for QAM
|   |       Electronic Dispersion Compensation
|   |       Electronic Precomp of Intra-Channel Nonlinearities
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|   |       Enhanced Gaussian Noise (EGN) Model
|   |       Four Wave Mixing
|   |       FWM Conversion Efficiency
|   |       Gaussian Pulse Propagation
|   |       Ideal Digital Back Propagation (DBP)
|   |       Inter-modal Cross Phase Modulation
|   |       Inter-Modal FWM
|   |       Intrachannel FWM and XPM
|   |       Mitigation of Intra-channel Nonlinear Effects
|   |       Modulation Instability
|   |       NLIN Accumulation in WDM Systems
|   |       Nonlinear Noise Cancellation
|   |       NRZ pre-post Compensation
|   |       OSNR Penalty
|   |       Reducing FWM Effect Using Different Channel Spacing
|   |       RZ pre-post Compensation
|   |       Signal Analysis in a Link
|   |       Soliton vs. RZ System
|   |       SPM and XPM
|   |       Supercontinuum Pulse Generation
|   |       XpolM Principle (Part 1)
|   |       XpolM Principle (Part 2)
|   |       XpolM Principle
|   |
|   +---Multimode Fibers
|   |       Generation of TRIPs for GI-MMF
|   |       Generation of WB TRIPs for MMF
|   |       Optimized Few-Mode Fiber Profile
|   |       Simulation of Multicore Fibers - Getting Started
|   |
|   +---Optical Amplifiers
|   |   |   AmpAnalyzer
|   |   |   Backward-Pumped EDFA
|   |   |   EDFA Design Validation
|   |   |   Gain and Noise Figure Spectra
|   |   |   Gain and Power
|   |   |   Gain Tilt Measurement
|   |   |   Noise Figure of Fiber-Optic Parametric Amplifiers
|   |   |   Optical Power Equalization
|   |   |   Power Conversion Efficiency
|   |   |   Pump Efficiency
|   |   |   Raman Gain vs. Wavelength
|   |   |   Sat Gain Spectrum
|   |   |   Saturation Characterization
|   |   |   Spectral Characterization
|   |   |
|   |   +---AmpAnalyzer
|   |   |   +---Attachments
|   |   |   +---Inputs
|   |   |   +---Outputs
|   |   |   +---Reports
|   |   |   \---Resources
|   |   \---Backward-Pumped EDFA
|   |       +---Attachments
```

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|   |       +---Inputs
|   |       +---Outputs
|   |       +---Reports
|   |       \---Resources
|   +---Optical Crosstalk
|   |       Channel Offset Penalty
|   |       Extinction Ratio
|   |       Impact of Crosstalk in NxN AWG Router
|   |       Inband Crosstalk Penalty
|   |       Inband vs. Interband Crosstalk
|   |       Multipath Crosstalk - CW Source
|   |       Multipath Crosstalk - Modulated
|   |       Number of Interferers
|   |       Orthogonal and Parallel Polarization
|   |       Polarization Alignment
|   |
|   \---Raman Scattering
|           Bidirectional Raman Processes
|           Cross-Phase Modulation Due to Stimulated Raman Scattering
|           Import of OTDR Data
|           Nearly-Constant Signal Levels
|           PMD Statistics of Raman Gain
|           Raman Power Transfer System
|           Raman Power Transfer
|           RBS and Pump-Signal Overlap in DRA
|           Simulation of DRA (part 1)
|           Simulation of DRA (part 2)
|
+---Doped Fiber Amplifiers
|       1.4 kW continous-wave YDF laser
|       EDF Ring Laser
|       EDFA Preamplifier Design
|       EYDF MOPA Source
|       High Power Multimode DBR YDFL
|       L-Band Preamplifier using 3-Level Laser Model
|       L-Band TDFA
|       Optimization of GEF
|       S-Band TDFA with Dual-Wavelength Pumping
|       S-Band TDFA with Single-Wavelength Pumping
|       Saturation of Preamplifier
|       Single Stage L-Band Amplifier
|       TDFA - Effect of Cross Relaxation
|       Two Stage C-Band Amplifier
|       Two Stage L-Band Amplifier
|       YDFA gain and noise spectra
|       YDFA gain vs fiber length
|
+---Doped Fiber Amplifiers (SDM)
|       DFAMM - DMG via Different Pump Mode
|       DFAMM - DMG via Doping Profile Shape
|       DFAMM - DMG via Refractive Index Profile
|       DFAMM - Getting Started
|       DFAMM - Mode Coupling
|       DFAMM - Overlap Approximation
```

|
+---**Doped Waveguide Amplifiers**
| Er Concentration - Influence on Gain
| Upconversion Coefficient - Influence on Gain
| Waveguide Length - Influence on Gain
|
+---**Dynamics & Transients**
| 4-Node Ring Network
| Active Harmonic Mode-Locking of Er-doped Fiber Laser (Build-Up)
| Burst Mode Networking
| Dynamic of Surviving Channels in Fiber Raman Amplifier
| Dynamic ROADM with DCE
| EDFA Control Scheme
| EDFA Dynamics using Switched WDM Channels
| Gain Clamped Amplifier
| ROADM - Mitigation of EDFA Transients
| Single EDFA Power Dynamics
| Transient Effects in Fiber Raman Amplifiers
|
+---**Electric Circuits**
| Active Sallen-Key Low-Pass Filters
| Capacitors Network
| Conflict of Current Sources in the same Branch
| Conflict of Voltage Sources at the same Node
| Coupled Series Inductors
| Current Sources and Ammeter
| DIP Switch as Multiport Cosimulated Electrical Element
| Earth as Source of Zero Potential
| Ideal Gyrator as Cosimulated Electrical Element
| Infinite Resistor Series
| Kirchhoff Current Law
| Kirchhoff Voltage Law
| Parallel Capacitors
| Passive RC Filters
| Undefined Current in Zero-Resistance Circuit Loops
| Undefined Currents in Parallel Zero-Resistance Links
| Voltage Sources and Voltmeters
|
+---**Free Space**
| FMCW LiDAR System
| FSO Downlink Simulation Using Phase Screens
| Inter-satellite FSO Link with BPSK and DSP
| Mitigation of Scintillation by Aperture Averaging
| NRZ vs PPM in a FSO Downlink
| PPM in a FSO Link
| Scintillation on a Free Space Link
| Scintillation on a FSO Satellite Link
| Scintillation on Received Electrical Power
|
+---**Getting Started**
| Advanced Discretization in PhotonicsTLM
| BER Estimation in Fiber Transmission Systems (Aperiodic BC)
| BER Estimation in Time-Domain Simulations
| Characterization of Bragg Gratings

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|       Dynamic Polarization Scrambler Model
|       Electrical Filter Frequency Response
|       Electrical Filter Impulse Response
|       Flat vs Parabolic Gain Shape Models
|       Interface with VPIdeviceDesigner
|       Laser Model Comparison TLLM vs SMRE
|       Measured Transfer Function
|       Modeling Multisection Bragg Gratings
|       Modeling Thermal Effects in Lasers
|       Optical Filter Impulse Response
|       Parabolic Gain Shape in PhotonicsTLM
|       PhotonicsTLM - Getting Started
|       PhotonicsTLM - Noise Power Models
|       PhotonicsTLM - Noise Shape Models
|       PhotonicsTLM - Three-Section Tunable Laser
|       PhotonicsTLM - Wizard Macro
|       PIC Elements - Measured Models
|       Recovering the Logical Information with the LogicAddChannel
|       Simulation of Measured Passive Components
|
+---High Capacity WDM
|       1 Tb OFDM Superchannel
|       10G-40G-100G WDM
|       10Gbps-40Gbps Upgrade using Raman Amplifier
|       12D Coding for SDM
|       160x20Gbps over 1500 km
|       320x10Gbps over 600 km
|       400G WDM - 64xDP16QAM System
|       40x42.7Gbps over 3600 km Raman
|       82x10Gbps Bidirectional DRA
|       82x10Gbps using Dual Band DRA
|       82x10Gbps using Raman in DCF
|       82x40Gbps over 300 km
|       All-Optical OFDM
|       Frequency Comb based QAM
|       Nyquist Superchannel
|       SDM MIMO
|       Ultra High Capacity SDM System
|
+---High Speed TDM
|       100 Gbps ETDM - Transmitter Limitations
|       160 Gbps OTDM DQPSK with Clock Recovery
|       320 Gbps Transmission and Demultiplexing using EAM
|       OTDM to WDM 4x40 Gbps Transmultiplexer
|
+---Hybrid Amplifiers
|       Discrete Raman with EDFA
|       Distributed Raman with EDFA
|       Repeaterless System with ROPA
|
+---Lab-Ready Setups
|   +---Communication with Equipment
|   |       Generic AWG and Scope (LeCroy)
|   |       Interacting with LabVIEW
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| | Reading from Optical Equivalent-Time Sampling Scope
| | Reading from Real-Time Scope
| | Synchronized Arbitrary Waveform Generators
| | Write to Arbitrary Waveform Generator
| |
| \---Systems
| Discrete Multitone Transmission for High-Speed Optical Access
| DSP for 16QAM
| Generation and Detection of 4D Modulation Formats
| OFDM for Optical Communication
| PAM Transmission for High-Speed Short-Haul & Access Systems
| RoF Link
|
+---**Laser Characterization**
| Above Threshold Static Spectrum
| Below Threshold Spectrum
| Characterization of Rate Equation Laser Model
| Dynamic Time-Averaged Spectrum
| Efficient Laser L-I Sweep
| Freq Fluctuation Spect. and Linewidth
| IM and FM Response
| Intensity Noise in Multimode Lasers
| Junction Voltage
| Laser Parameter Extraction
| Laser Power Control
| Laser Tuning Control
| Measuring Mode Partition Noise
| MQW Laser Characterization with TestSetLaser
| Phase Portrait - Mode Hopping
| Phase Portrait - Self Pulsations
| RIN Characterization with RIN_Analyzer
| SMSR Measurement on DFB Laser
| SOA Transfer Characteristic
| Time Resolved Freq. Chirp
| Timing Jitter
| Wavelength and Power
|
+---**Lasers & SOAs**
| Adjusting Two-Section DFB Lasers
| Bandwidth Enhancement with Optical Injection Locking
| Chirped Grating DFB Laser
| Complex Coupled Laser
| Double Tapered Bow-Tie Laser
| Fabry Perot Laser
| FBG Stabilized Laser
| Gain-Clamped SOA
| Grating Controlled Fabry-Perot
| Injection Locked Laser
| Laser with Feedback
| Loss Coupled Laser
| MQW DFB Laser
| Multiple-PhaseShift DFB Laser
| Push-Pull DFB Laser
| QWS DFB Laser with Feedback

|	Ring-based Tunable Laser
|	Semiconductor Ring Laser
|	SOA Characterization with TestSetSOA
|	SOA Nonlinear Polarization Rotation
|	SOA with Measured Gain Spectra
|	SOA_Measured - Gain Saturation
|	SOA_Measured - Gain Spectra
|	SOA_Measured - Signal Waveform
|	Soliton with Mode Locked Laser
|	Tapered SOA
|	Three Section FP-DBR
|	Tunable Distributed Amplification DFB Laser
|	Two Section FP-DBR
|	Widely Tunable Hybrid III-V on Si Lasers
|
+---**Long Haul**
|	2R Regenerated System
|	32x10Gbps over 7500 km
|	32x42.7 Gbps over 6050 km
|	64x10Gbps over 7500 km
|	Chirped Modulation 5400 km
|	Collision-Induced Jitter (Matlab)
|	Dispersion Managed Sections
|	Jitter versus Distance (Matlab)
|	Nonlinear Effects in a DPSK System
|	OFDM for Long-Haul Transmission
|
+---**Modulation & Coding**
|	4D Signal Generation & Detection
|	Concatenated FEC for DVB-S2 Standard
|	Data-Aided Cycle-Slips Detection and Correction
|	Importing LDPC Codes
|	LDPC-IRA vs regular LDPC
|
+---**Modulation & FEC**
|	4D System with FEC
|	Coded Modulation II
|	Coded Modulation
|	Concatenated Codes to Combat Cycle Slips
|	Concatenated FEC for DVB-S2 Standard
|	Data-Aided Cycle-Slips Detection and Correction
|	Importing LDPC Codes
|	LDPC-IRA vs regular LDPC
|	Pilot-Aided DSP and FEC
|
+---**Modulation Binary**
|	100 Gbps - Serial Modulation Formats
|	40 Gbps using Thin Film Filter
|	40 Gbps VSB using Ideal Filter
|	Alternate Polarization Modulation vs NRZ
|	Amplitude Histograms for Binary Modulation
|	CRZ Pulse Compression
|	CRZ vs RZ
|	Dispersion Supported System

| DPSK compared to NRZ
| DPSK precoders
| DPSK Rx with Nonlinear Differential Amplifier
| Duobinary vs NRZ
| Ideal VSB Filter Frequency Response
| IM-DPSK compared with NRZ
| Optical Manchester Coder System
| Phase-Shaped Binary System
| Reduction of IFWM by Pairwise Alternate Polarization
| Single Side-Band (SSB) System
| Vestigial Side-Band (VSB) Modulation
|
+---**Modulation DmPSK & PAM**
| Amplitude Error PAM4 Jitter
| Amplitude Histograms for Quaternary Modulation
| BER vs Dispersion for ASK, DPSK and DQPSK
| BER vs OSNR for ASK, DPSK and DQPSK
| D8PSK Direct Detection Multilevel
| DmPSK Differential Decoding at Rx
| DPSK-3ASK Level Optimization
| DQPSK vs NRZ
| Importing Experimental PAM4 Signals
| PAM8 28 Gbaud Optical Ethernet System
| Quaternary NRZ System
|
+---**Modulation IQ**
| 100Gbps using 2SC-PolMux-DQPSK
| 112Gbps - PolMuxQPSK
| Bit to Symbol Mapping
| Coherent 8PSK System
| Coherent QAM I
| Coherent QAM II
| Differential Encoding for mQAM
| Generation, Detection and Processing of Electrical QAM Signals
| Hexagonal Signal Constellation
| Kramers Kronig Receiver
| Measured IQ Modulator with Nonlinear Electrical Drive
| Performance Comparison for Different Constellations
|
+---**Modulation IQ DSP**
| Data-aided vs Blind DSP
| DSP for 16QAM
| DSP for 32QAM
| DSP for 64QAM
| Frequency-domain CD Compensation using DSP
| Gardner Clock Recovery
| Insert and Remove Pilot Symbols
| ML Carrier Phase Estimation
| mPSK CD Compensation with DSP
| mPSK Phase Correction with DSP
| mQAM CD PMD Compensation with DSP
| mQAM Phase Correction with DSP
| mQAM PMD Compensation with CMA DSP
| Nonlinear Phase Noise Mitigation with DSP

|	Stokes Space Polarization Demultiplexing
|	Time-Domain MIMO Equalizer for Coherent Systems
|
+---**Modulation Multicarrier**
|	80Gbps Coherent OFDM
|	Digital Subcarrier Multiplexing
|	MultiCAP
|	OFDM - Generation and Detection
|	OFDM Subcarriers Encoding & DSP
|	SSB Nyquist QAM SCM with Kramers Kronig Receiver
|
+---**Modulation Multilevel**
|	Generation, Detection and Processing of Electrical QAM Signals
|	Importing Experimental PAM4 Signals
|	OFDM - Generation and Detection
|	OFDM Subcarriers Encoding & DSP
|
+---**Modulation Ndim**
|	4D PS-QPSK vs. PDM-QPSK (FEC)
|	4D Set-Partitioning Modulation
|	4D Signal Generation & Detection
|	8D Alamouti Coding
|	8D Modulation Format for Inter-Channel Nonlinearities Reduction
|	Receivers for Direct Detection of Stokes Vector
|	Stokes Vector Modulation
|	Time-Domain Hybrid Modulation using Golay Coding
|
+---**Modulation Shaping**
|	Arbitrary Geometric and Probabilistic Shaping
|	CPR for PS-mQAM
|	Pilot-Aided Carrier Recovery for PSmQAM
|	Probabilistic Shaped Constellation
|	Probabilistic Shaping (PS) with FEC
|	Probabilistically-Shaped Square mQAM
|	Short Blocklength PS for NLIN Tolerance
|
+---**Optical Networks**
|	3x Ring with OXC & ADMs
|	CWDM Shared Protection
|	Dynamic Reconfigurable Networks
|	Optical Crosstalk
|	OSNR Variations in OADM Chain
|	OXC Interconnected Rings
|	Packet Header Recognition
|	Protection Switching 1
|	Protection Switching 2
|	Ring Crosstalk
|	Ring Routing
|	SOA Data Patterning (XGM)
|	SOA XPM Wavelength Converter
|	Wavelength Converting OXC
|	Wavelength Routing 3xOXC
|	WDM Cross-Connect
|

+---**Optical Signal Processing**
| Bidirectional Nonlinear Ring Resonator
| Dynamic Channel Equalizer
| Frequency Combs in Nonlinear Ring Resonators
| FWM in Silicon Waveguides
| Integrated DFB-SOA Regenerator System
| Integrated Recirculating Optical Buffer
| MZI XPM Wavelength Converter
| Nonlinear Switching in Ring Resonator
| NRZ to RZ Converter
| Optical Pumping of SOA for Wavelength Conversion
| Optical Sigmoid Activation Function
| Sagnac Loop Switch
| SHG and SFG of Multiple CW Laser Signals
| SHG Conversion Efficiency of PPLN
| SOA Gate Switch
| SOA Integrated with Multi-Ring Resonator
| SOA MZI Gate Switch with Reverse Input
| SOA Phase Shift
| SOA XGM Regenerator
| Solitons and Supercontinuum in Nonlinear Waveguides
| WDM to OTDM Transmultiplexer
|
+---**Passive Circuits**
| Add-drop De-multiplexer with Multiple Ring-couplers
| Automated Design of Multi-Ring Filters
| AWG with Flattened Spectral Response
| Bandwidth Tunable Filter with Double Ring-loaded MZI
| Bend-Induced Losses in Quarter-Circle Waveguide
| Bidirectional Polarization Components
| Characterization of Backreflection in Grating Couplers
| Characterization of MMI-based 90H
| Characterization of Optical Filters
| Coupled-Resonator-Induced Transparency
| Design of Apodized Linearly Chirped Gratings
| Design of Multi-Ring Filters
| Design Optimization of MMI Devices
| Effective Index Definition in PIC Elements
| GratingCoupler as Cosimulated PIC Element
| High-Order Microring Add-Drop Filter
| Induced Transparency in Photonic Switching Element
| Interleave Filter with Cascaded MZIs
| Measured CRIT
| Multimode Cosimulated PIC Elements
| Multiply-Cascaded Phase-Shifted Bragg Gratings
| Non-Reciprocal Waveguide Bragg Gratings
| OPA 2D Beam Steering for LiDAR
| Optimization of Ring-Loaded Unbalanced MZI
| Polarization Conversion in Ring Resonator
| Power Splitters based on 5x5 MMI Coupler
| Restoring Device Transfer Function from Measurements
| Ring Filter with Dispersive Coupling
| Ring-loaded MZI
| Sampled Gratings in Active and Passive Waveguides

| Time-domain modelling of AWGs
| Tolerances for High-Order Microring Filters
| Tunable Delay with Two-cascaded Ring-resonator
| Waveguide Group Index Verification Methods
| WgGrating as Cosimulated PIC Element
| WgSplitter as Cosimulated PIC Element
|
+---**Raman Amplifiers**
| Bidirectional Dual Band
| Cascaded Raman Amplified Spans
| Cascaded Raman Scattering
| Comparison of Pumping Schemes
| Dual Band DRA
| Dual Band in DCF
| Dual-Order vs 1st Order Raman Pump
| Gain Flattening of DRA Output
| Multi-Pump Gain Flattening
| Optimization of a 12-Pump FRA
| Optimization of a 2-stage FRA
| Optimization of a FRA over Disjoint Spectral Ranges
| Rayleigh Scattering Limitation in DRA
| Third-Order Cascaded Raman Amplification
|
+---**Short Reach**
| 10Gb Ethernet over MMF
| 25Gbaud PAM4 with Multimode VCSEL and OM4 Fiber
| 400GBase-SR4.2 with MM VCSEL and Wideband Fiber
| 800G-FR4 WDM for Ethernet
| DFE For Modal Dispersion Compensation of MMF
| DP16QAM in Repeaterless System with ROPA
| EAM for Very-Short-Reach (VSR) Applications
| MIMO Transmission over Multimode Fiber
| MLSE for PAM4 Short Reach System
| MMF_50um_Offset
| MMF_62.5um_Offset
| Multimode Fiber - Signal Response
| PAM4 - Eye Skew in MM Transmission
| PAM4 for 400G Ethernet over SMF
| PAM4 Optical Interconnect
| PAM4 VCSEL with MPI
| Submarine System
| VCSEL-MMF Launch System Using Zemax OpticStudio
| VSB Signal and Kramers Kronig Receiver
| WDM of 400G ZR Channels
|
+---**Simulation Techniques**
| +---**BER Estimation**
| | BER - Monte-Carlo
| | BER Auto Gain with Script
| | BER Automatic Gain Setting
| | BER Estimator Comparison DQPSK
| | BER Estimator Comparison I
| | BER Estimator Comparison II
| | BER for Raman and PMD

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|   |       BER for Various LP Filters
|   |       BER for Various SOP
|   |       BER from Deterministic Noise
|   |       BER from Sampled Signals
|   |       BER Improvement using FEC
|   |       BER Penalty Calculation
|   |       BER Stochastic - Chi2 Mode
|   |       BER Stochastic - Gauss Mode
|   |       BER Stochastic - Multiple Runs
|   |       BER vs. Dispersion
|   |       BER vs. Extinction Ratio (Amplified System)
|   |       BER vs. Jitter
|   |       BER vs. Noise DOP
|   |       BER_Multilevel Burst Mode
|   |       BER_Multilevel Metasymbols Definition
|   |       Dispersion Penalty with Fit
|   |       DPSK Gauss vs. Nongauss
|   |       ISI Length with DM Laser
|   |       ISI Length with Fiber
|   |       OSNR Penalty Estimation
|   |       Parameterized vs. Blocks (ASK)
|   |       Parameterized vs. Blocks (DPSK)
|   |       Parameterized vs. Blocks (DQPSK)
|   |       Power Penalties Measurement
|   |       Required OSNR and OSNR Penalty Estimation
|   |       Rx_DPSK_BER_KL - Deterministic (CD & Rx Parameters)
|   |       Rx_DPSK_BER_KL - Stochastic (Nonlinear Phase Noise)
|   |
|   +---Cosimulation
|   |   +---ADS
|   |   |       20 Channel NTSC System
|   |   |       Chip-to-Chip Transmission over VCSEL-Multimode Fiber
|   |   |       Direct Detection Example
|   |   |       Frequency Response
|   |   |       Modulator Driver
|   |   |       Pre- and Travelling Wave Amplifier for Modulator Driver
|   |   |
|   |   +---COM
|   |   |       Electrical Signal Generation (COM)
|   |   |       Filter (COM)
|   |   |       Logical Info (COM)
|   |   |       Optical Signal Generation (COM C#)
|   |   |       Optical Signal Generation (COM VB.NET)
|   |   |       Optical Signal Saving (COM)
|   |   |       Power Meter (COM)
|   |   |
|   |   +---EDA
|   |   |       Arranging NGSPICE Cosimulation
|   |   |       Multiband-OFDM in RoF System
|   |   |       TIA for Direct Detection Receiver (NGSPICE)
|   |   |
|   |   +---Library
|   |   |       Electrical LP Filter
|   |   |       Electrical Signal Generation (Lib)
```

```
|   |   |       Filter (Library)
|   |   |       FP Filter (T&R)
|   |   |       Function Parameters in Cosimulation (Lib)
|   |   |       Logical Info(Library)
|   |   |       Optical Signal Generation (Lib)
|   |   |       Optical Signal Resampling
|   |   |       Power Meter (Library)
|   |   |       Sample Mode Filter
|   |   |
|   |   +---Matlab
|   |   |       Electrical Signal Generation (Matlab)
|   |   |       Filter (Matlab)
|   |   |       Logical Info(Matlab)
|   |   |       Optical Signal Generation (Matlab)
|   |   |       Power Meter (Matlab)
|   |   |       Trapezoidal AWG (Matlab)
|   |   |
|   |   \---Python
|   |           Distributed MZ Modulator (Python)
|   |           Electrical Filter (Python)
|   |           Electrical Signal Generation (Python)
|   |           Function Parameters in Cosimulation (Python)
|   |           Logical Info (Python)
|   |           Optical Filter (Python)
|   |           Optical Power Meter (Python)
|   |           Optical Signal Generation (Python)
|   |           Photodiode (Python)
|   |           Power Meter (Python)
|   |           Power Meter El (Python)
|   |           Save and Load Data Files
|   |           Spectrogram of Multiplexed Signal
|   |           Waterfall Plots of Soliton Evolution
|   |
|   +---General
|   |       Assigning logical information using the LogicAddChannel
|   |       Combining Boundary Conditions (Advanced)
|   |       Combining Boundary Conditions
|   |       Controlling Complexarray Parameters
|   |       Controlling Float Parameters
|   |       Controlling Floatarray Parameters
|   |       Controlling Parameterized Signals and Distortions
|   |       Controlling String Parameters using InputFile
|   |       Controlling String Parameters
|   |       Creating SFB and MFBs
|   |       Downsampling Aperiodic Optical Signals
|   |       Efficient WDM System Design
|   |       Estimation of GPU Performance
|   |       Gibbs Phenomenon
|   |       Handling Deadlocks (part1)
|   |       Handling Deadlocks (part2)
|   |       Labeled Links and Wiring Tools
|   |       Labeled Links for Interconnection Markup
|   |       Labeled Links for WDM System
|   |       Macro Tutorial
```

```
|   |       Mixed 100 - 40Gbps Generation
|   |       Mixed MFB and SFBs
|   |       Mixed Signal Representations
|   |       Multiple Runs and DSP
|   |       Multiple Symbol Rate Simulation
|   |       n-input Expression
|   |       Overlap Methods in Aperiodic Fiber Simulations
|   |       Overlap-Add  Method in Fibers
|   |       Overlap-Save Method in Fibers
|   |       Overlap-Save Method with BC_Converter
|   |       PRBS Settings
|   |       Resampling and Limiting
|   |       Resampling Options
|   |       Setting the Source Representation
|   |       Signal Sampling - Getting Started
|   |       Simulation of Noise in Electrical Signals
|   |       Specifying Order of Module Execution
|   |       Using LinkAnalyzer and VPIdesignRules for System Analysis
|   |       Using Settings in Analyzer Modules
|   |
|   +---Getting Started
|   |       A Simple WDM System
|   |       GUI Example Stage 1
|   |       GUI Example Stage 2
|   |       GUI Example Stage 3
|   |       Parameter Expressions
|   |
|   +---Interactive Sweeps
|   |       BER Curve vs. BW, run first
|   |       BER Curve vs. BW
|   |       BER Curve vs. Dispersion
|   |       BER vs. Length and D
|   |       BER vs. Length Optimization
|   |       Dynamic WDM Comb with Control
|   |       Generating Waveforms with Sweeps
|   |       Simple Optimization
|   |       Simple Sweep for Module Parameter Variation
|   |       Swept Optimization
|   |       Yield of a 1 to 8 Splitter
|   |
|   +---Other Sweep Techniques
|   |       BER Curve vs. Length
|   |       BER Optimization in DPSK System
|   |       BER vs. Received Power Graph
|   |       Component Comparison
|   |       Conditional Choosing of Modules
|   |       DPSK-3ASK Optimization
|   |       Rosenbrock Function Minimization
|   |       Sweeps with Python Macros and Scripts
|   |
|   +---PMD Emulation
|   |   |   2nd Order Emulator Impulse Response
|   |   |   2nd Order Emulator vs. Coarse Step
|   |   |   Averaged SOP and DOP
```

```
|   |   |   Coarse Step Model - Biased PMD Statistics
|   |   |   Coarse Step Model - Width Deviation
|   |   |   Efficient Simulation of Dynamic Polarization Effects
|   |   |   Jones Matrix of Fiber Spans
|   |   |   Polarization-Independent Electrooptic Depolarizer
|   |   |   Simple Electrooptic Polarization Scrambler
|   |   |   TSJM - Birefringence
|   |   |   TSJM - Fiber
|   |   |   TSJM - Polarization Transformation
|   |   |   ViStokes_Ave
|   |   |
|   +---SED
|   |       Access Log Messages
|   |       BER vs. Laser Power Curve
|   |       DPSK-3ASK Level Optimization (SED)
|   |       Simple Synchronous Simulation
|   |
|   +---Signal Processing Library
|   |       3-Bit Ripple Counter
|   |       4-Stage PRBS Generator
|   |       4-Stage Shift Register
|   |       Adding Jitter To Electrical Waveform
|   |       Automatic Gain Flattening
|   |       Binary Counter
|   |       D-Type Latch
|   |       Data Post Processing
|   |       Edge-Triggered D-Type Flip-Flop
|   |       Electrical Phase Shift (Signal Proc)
|   |       Electrical Signal Sources
|   |       Finding Minimum and Maximum Values
|   |       Generating Ramps and Control Waveforms
|   |       Interpolation using Signal Processing Modules
|   |       Logic Gate Truth Tables
|   |       Matrices - Basic Matrix Functions
|   |       Matrices - Inverters and Transposers
|   |       Matrices - Simple Arithmetic Functions
|   |       Matrices - Toeplitz Matrix Decomposition
|   |       Minimum of a Function of One Variable
|   |       S-R Latch with Enable
|   |       Set-Reset Latch
|   |       Signal Processing FIR Filters
|   |       Signal Processing IIR Filters
|   |       Slew-Rate Limiter (Signal Proc)
|   |       Up- & Downsampling using Signal Processing Modules
|   |       VCO Driven by Digital Data
|   |
|   \---Simulation Scripts
|           BER vs. Laser Power
|           File Input using a Simulation Script
|           File Output using a Simulation Script
|           Optimization using Bisection Method
|           OSNR Pre-Emphasis
|           Sweep using a Simulation Script
|           XPM Converter Transfer Characteristic
```

```
|
+---Subsystem
|   \---Receiver Electronics
|           Continuous Time Linear Equalizer
|           Electronics in an Optical Receiver
|           Equivalent Electrical Noise Bandwidth
|           Limiting Amplifier Transfer Characteristic
|           Lossy Electrical Integrator Performance
|           Thresholder with Hysteresis
|
+---Subsystems
|   +---Optical Amplifiers
|   |       AmpBlackBoxSOA vs. WDM SOA
|   |       Gain-Clamped SOA
|   |       Optical Amplifier Gain Slope Measurement
|   |       Optimization of a 12-Pump FRA
|   |       Optimization of a 2-stage FRA
|   |       Optimization of a FRA over Disjoint Spectral Ranges
|   |       Phase Sensitive Fiber-Optic Parametric (PSA)
|   |       Principle of Fiber-Optic Parametric Amplification (FOPA)
|   |       Three EDFA Model Types
|   |       WDM SOA Gain Frequency Dependence
|   |
|   +---Optical Sources
|   |       Active Harmonic Mode-Locking (CW generation)
|   |       Analog Laser - Noise Characterization
|   |       DBR Fiber Laser for Sensor Applications
|   |       Diffraction in Imaging Systems
|   |       Fresnel and Gabor Zone Plates
|   |       Laser Parameter Extraction
|   |       mJ Q-switched cladding-pumped Yb-doped fiber laser
|   |       Peak Optical Frequency Detector
|   |       Primary Aberrations in Imaging Systems
|   |       RIN Characterization
|   |       VCSEL (Multimode) Equivalent Circuit
|   |       VCSEL (Multimode) LI Characteristic
|   |       VCSEL (Multimode) Modulation Characteristic
|   |       VCSEL (Multimode) RIN Characteristic
|   |       VCSEL LI Characteristic
|   |       VCSEL Thermal Frequency Shift
|   |
|   +---Passive Components
|   |       AWG - Impact of Passband Ripple for DPSK
|   |       AWG - Impact of Passband Shape for OOK
|   |       Demultiplexing WDM Channels
|   |       Disp Comp Filter Characterization
|   |       Dispersion and Attenuation Compensation
|   |       FBG - Impact of Cladding Modes for DPSK
|   |       Long-Period Fiber Grating - Temperature Sensor
|   |       Maximally Flat ARMA Filter
|   |       Measured Transfer Function
|   |       MZI Test
|   |       Random Parameter Fluctuations
|   |
```

| +---**PMD Compensation**
| | 1st Order Compensator
| | 2nd Order Compensator
| | 40 Gbps NRZ with All Orders of PMD
| | 40 Gbps OOK with PMD Emulator
| | Adaptive Filters for PMD Compensation
| | Chromatic Dispersion Insensitive PMD Monitoring
| | Cross-Phase Modulation Induced Polarization Scattering
| | Distortion Estimation by RF Spectrum
| | Importance Sampling for PMD (part 1)
| | Importance Sampling for PMD (part 2)
| | Performance Limitations due to PMD
| | Source Polarization PMD Compensation
| |
| +---**Receiver Electronics**
| | Adaptive FIR control using RLS
| | Clock Recovery of Distorted Signal
| | Coherent Binary FSK System
| | Coherent Binary PSK System
| | Continuous Time Linear Equalizer
| | DFE for Chromatic Dispersion Compensation
| | Electronics in an Optical Receiver
| | ENoB Estimation in ADC
| | Equivalent Electrical Noise Bandwidth
| | Full Phase-Locked Loop
| | Limiting Amplifier Transfer Characteristic
| | Link Illustrating Receiver Integrated Circuits
| | Lossy Electrical Integrator Performance
| | MLSE Receiver for PAM4
| | MLSE vs. Classical Receiver Performance
| | PhaseRecovery for Coherent BPSK
| | PLL Phase and Jitter Detector
| | RxViterbi Adaptive Equalization
| | Thresholder with Hysteresis
| | Volterra Equalizer
| |
| +---**Receivers**
| | APD Photodiode Current-Voltage Characteristic
| | BER vs Threshold Level
| | Direct Detection Example
| | DPSK 40Gbps - Laser Drift and MZI Delay
| | Histograms from Eye Diagrams Using Python
| | Histograms from Eyes using Signal Processing
| | Homodyne Example
| | Modelling Noise in Amplifiers and Photodiodes
| | Penalty and Sensitivity Analysis for DPSK
| | PIN Photodiode Current-Voltage Characteristic
| | Power Penalty Estimation
| | Setting the Sensitivity of a Receiver
| |
| \---**Transmitters**
| Chirp of MZ Modulator
| CW vs. RE Model - External Modulation
| DAC Requirements for Electrical OFDM

```
|           Data Sheet Model - Direct Modulation
|           DQPSK - Laser Linewidth
|           Drive Signals with Variable Crossing Level
|           EAM - Phase Properties
|           EAM - Polarization Properties
|           EAM-modulated Single Channel Transmission
|           Encircled Flux (Launch Conditions)
|           Linear Digital Pre-Distortion (DPD) for Optical Transmitters
|           MZ Different Duty Cycles
|           MZM-based Generation of PAM4
|           Power Penalty using 10 Gbps DML
|           Power Penalty using 10 Gbps EML
|           RE Model - Direct Modulation
|           RE Model - Dynamic Response
|           RE Model - External Modulation
|           Ring Modulator - Step 1 (Optical Spectrum)
|           Ring Modulator - Step 2 (Static Modulation)
|           Ring Modulator - Step 3 (Electrical Circuit)
|           Ring Modulator - Step 4 (Small-Signal Modulation)
|           Ring Modulator - Step 5 (PAM4 Modulation)
|           Selective Mode Excitation with SLM
|           SiP IQ Modulator
|           Small Signal Characterization of MZM
|           Speed of Direct Modulation
|           Timing Jitter Histograms with Interpolation
|           VCSEL - MMF Coupling (Free Space Propagation)
|           VCSEL Thermal Behavior
|           Volterra Component Modeling
|
+---Systems
|       16-QAM over 10km SMF
|       50G PAM4 with SiP MRM
|       AWG - Impact of Passband Shape for OOK
|       Cascaded AWG 100-Channel PIC
|       Chip-to-Chip Transmission System
|       Directly Modulated NRZ System
|       LED System
|       Propagation of Multiple Laser Modes
|       SG DBR Laser for FMCW LiDAR
|
+---Test & Measurement
|   +---Chromatic Dispersion
|   |       CD - Dispersion Delay Measurement
|   |       CD - Modulation Phase Shift Method
|   |       CD - Swept Homodyne Method
|   |
|   +---Importing Data
|   |       Coupling Computation using Zemax Files
|   |       Import Keysight HRS Data
|   |       Importing Data using ReadDataFile
|   |       Importing Keysight Chirp Files
|   |       Importing Signal (Matlab)
|   |       Importing Signal (Python)
|   |       Measured DM and EM Laser Penalty
```

| | Minimum-Phase Electrical Filter
| |
| +---**Multimode Fibers**
| | Dispersion Measurement of Multimode Fiber (Time Domain)
| | DMD Measurement of Multimode Fiber (Time Domain)
| | EMBc Measurement of Multimode Fiber (Time Domain)
| | OMB Measurement of Multimode Fiber (Frequency Domain)
| | OMB Measurement of Multimode Fiber (Time Domain)
| | OMBc Measurement of Multimode Fiber (Time Domain)
| | Statistical Modeling of GI-MMF
| |
| +---**Polarization**
| | Dynamic Polarization Scrambler Model
| | Methods for Measuring Stokes Parameters
| | PMD - Fixed Analyzer Method
| | PMD - Modulation Response Method
| | PMD - Mueller Matrix Method
| | PMD - Pulse Delay Method
| |
| \---**Transmitters**
| Chirp and Transfer Function Measurement
| Extinction Ratio Measurement
| Heterodyne Linewidth Measurement
| RIN Measurement Methods
| Self-Heterodyne Linewidth Measurement
| Self-Homodyne Linewidth Measurement
| TDEC - Transmitter and Dispersion Eye Closure for NRZ
| TDECQ - Transmitter and Dispersion Eye Closure for PAM4
|
+---**Transmitters & Receivers**
| | 4x40Gbps OTDM Transmitter
| | Balanced Receiver with Two Ring-couplers
| | Coherent Receiver with 90H 2x4-MMI
| | DPSK Modulator with Silicon Ring Resonator
| | Dynamic Behavior of Electroabsorption Modulator
| | EAM with Lorentzian Absorption Spectra
| | EAM with Measured Absorption Spectra
| | InP DQPSK Vector Modulator
| | InP-MZM Model with EAM Sections
| | Integrated DFB and EA
| | MZM - Distributed vs Lumped Waveguide Modeling
| | MZM Characterization with TestSetModulator
| | Optical Pulse Train Generation Using MZM Cascades
| | Phase Shifter Characterization
| | Polarization-Independent Electrooptic Depolarizer
| | Ring Modulator - Step 1 (Optical Spectrum)
| | Ring Modulator - Step 2 (Static Modulation)
| | Ring Modulator - Step 3 (Electrical Circuit)
| | Ring Modulator - Step 4 (Small-Signal Modulation)
| | Ring Modulator - Step 5 (PAM4 Modulation)
| | Silicon Traveling-Wave Modulator
| | Simple Electrooptic Polarization Scrambler
| | SOA Amplifier-Detector
| | SOA-REAM Integrated Transmitter

| | Static Characterization of Electroabsorption Modulator
| | VoltageControlled InP-MZM
| |
\---**Ultrafast Devices**
        Actively Mode-Locked Laser
        Hybrid Mode Locked Laser
        Measuring Mode-Locked Laser Jitter
        Passively Mode-Locked Laser
        Soliton Pulse Compression