Chirped-pulse WDM

Bahram Jalali
UCLA
jalali@ucla.edu
### Report Documentation Page

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<td>University of California LA</td>
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13. **SUPPLEMENTARY NOTES**

DARPA/MTO, WDM for Military Platforms Workshop held in McLean, VA on April 18-19, 2000, The original document contains color images.

14. **ABSTRACT**

15. **SUBJECT TERMS**

16. **SECURITY CLASSIFICATION OF:**

   - **REPORT:** unclassified
   - **ABSTRACT:** unclassified
   - **THIS PAGE:** unclassified
Applications

Telecom
  Mux/Demux
Analog-to-Digital Conversion
  Sampler
  Time Stretch
Spectroscopy
  Time domain spectral measurements
Other?
Spectral Slicing of Chirped Supercontinuum Pulses

Supercontinuum Source

Dispersion

Filter

\[ \text{time} \]
Supercontinuum Generation

Fiber Mode Locked Laser → Nonlinear Pulse Compression → Chirp Generation (SMF)

- 2 ps, 2 nm
- 0.1 ps

-20 dB Bandwidth: 194 nm

Wavelength (nm)

Power (dBm)

Wavelength (nm)

-20 dB BW: 194 nm

M. Islam, et al.

1400 1500 1600 1700
Chirped Pulse WDM

Multiplexing / Demultiplexing:

Time Stretching

Time Stretch ADC (TSADC)

\[ \text{BW} = f_{in} \]

\[ \text{Time Stretch} \times n \]

\[ \text{BW} = \frac{f_{in}}{n} \]

30 GSample/s, 5 GHz input, 4 bit

A.S. Bhushan et al., CLEO 2000.
Wavelength Division Sampling

Supercontinuum Optical Source

Dispersion

Electrooptic Modulator

A W G

BW = 1-20 THz
Problem with Dispersive Chirp Generation

Supercontinuum Source

Dispersion

WDM Source
Chirp-Free WDM Source Using True Time Delay

Supercontinuum Pulse

Intensity

Wavelength

AWG

Wavelength

λ₁

λ₂

λ₃

λ₄

Time

*Jalali and Yegnanarayanan, US Patent No. 5,793,907
Experimental Results

- 16 Channel Filter
- Integrated Delay Lines
- 10 ps Incremental delay

\[ \Delta \tau \Delta f = 0.49 \] (Autocorrelation)

Wavelength Division Sampling

Experimental 12 Gs/s continuous-time sampling

1GHz Modulation
12 Gsample/s Wavelength Division ADC

Modulation Frequency: 3600MHz
Aliased peak 400MHz

SFDR: 40dB
SNR: 32dB (5 bits)

FFT of one channel of digitized data

F. Coppinger, A.S. Bhushan, B. Jalali, IEEE Microwave Photonics Conference, MWP 1999
Time Domain Spectroscopy

- Eliminates need for broadly tunable sources
- Eliminates need for spectrometer
- Single shot measurements possible while maintaining low peak power

Experimental Verification

Resolution is comparable to the highest resolution, 0.08 nm, available for HP optical spectrum analyser (OSA).

Future Work

- Alternative low cost supercontinuum sources
  - Low cost fiber lasers
  - Alternative sources
  - Low cost, high power optical amplifiers
  - Other wavelength bands

- Beyond telecom, ADC, spectroscopy