Modulation Linearity Analysis of Si Ring Modulators

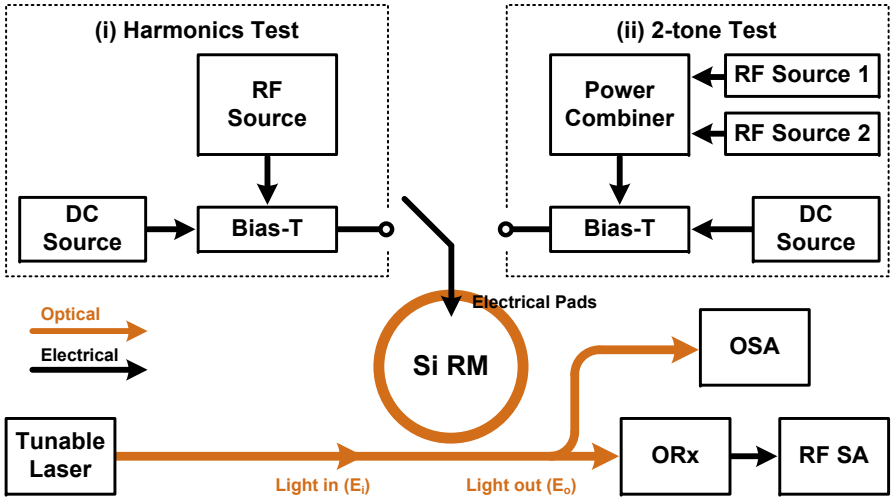
<Coupled-Mode Theory Model>

$$\frac{d}{dt}a(t) = \left(j\omega_r - \frac{1}{\tau} \right) a(t) - j\mu E_{in}(t)$$

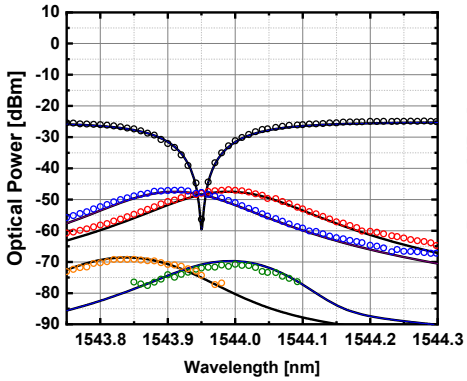
$$E_{out}(t) = E_{in}(t) - j\mu a(t)$$

→ 3 model parameters (τ_e, τ_l, n_{eff})
→ Transient solution
→ Fourier transform

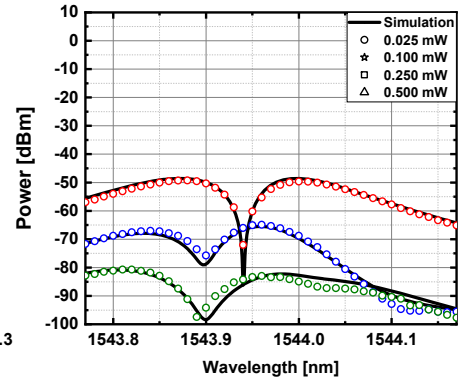
<Measurement Setup>



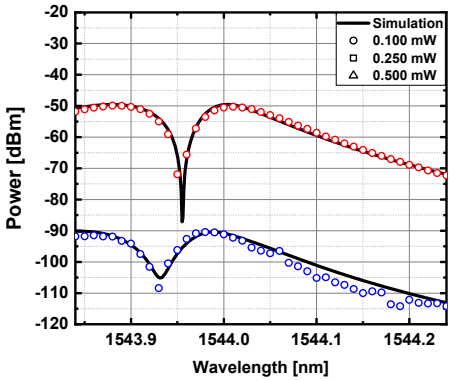
<1-tone OSA>



<1-tone ESA>



<2-tone ESA>



✓ ***Model expansion for self-heating effect and temperature variation***

Parametric Optimization of Si Ring Modulators

<Coupled-Mode Theory Model>

$$\frac{d}{dt}a(t) = \left(j\omega_r - \frac{1}{\tau} \right) a(t) - j\mu E_{in}(t)$$

$$E_{out}(t) = E_{in}(t) - j\mu a(t)$$

- ✓ Target: optimizing performance of Si RMs
- ✓ Modeling parameters: τ_e, τ_l
- ✓ Performance parameters:
  - Optical modulation amplitude (OMA)
  - 3-dB bandwidth (BW)
- ✓ Assumption:
  - 3-dB BW = 0.7* target data rate

<Optimization of O-band 40-Gbps Si RM>