satisfying the Bragg condition in the counter-propagating direction, multiplexing using different mode orders can be combined with wavelength division multiplexing as well. This allows us to potentially have a device which combines both wavelength division multiplexing and mode division multiplexing to generate even greater data capacity on a chip.

4. Conclusions

We have demonstrated mode division multiplexers utilizing coupled waveguides possessing periodic corrugations on a silicon chip. MDM devices multiplexing the zeroth to second order modes and the second to fourth order modes are fabricated and experimentally characterized. Higher order modes are observed to have stronger extinction ratios and larger drop port bandwidths, implying a stronger coupling coefficient. Tailoring of the drop port bandwidth is also demonstrated by changing the gap width of the coupled device. This design feature enables us to ensure that multiplexed modes have the same drop port bandwidth regardless of mode order. Since the location of the drop port may also be tailored using the pitch of the device corrugation, strategies combining both wavelength (up to 100 channels within the C – band [4]) and mode division multiplexing (3 – 5 modes) may be employed to achieve transmission capacities two orders of magnitude greater than that available to a single transmission medium. Operation by way of counter-propagating modes in periodic structures enables this device to combine its mode division multiplexing capabilities with wavelength division multiplexing functionalities to further augment the multiplexing capacity of the device.

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