Temporal coherence characteristics of a superluminescent diode system with an optical feedback mechanism

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Superluminescent diodes (SLDs) have been widely used for the optical measurements. The unique property of SLD is the combination of laser-diode-like output power and brightness with broad LED-like optical spectrum. Furthermore, the extremely high optical gain in SLD active region may result in very high optical power sensitivity to external optical feedback. Thus, once stimulated emission due to optical feedback occurs, the strength of the output light could be increased to achieve optical amplification, and the evident variation of the spectrum shape could also be observed. In this study, we explore the temporal coherence characteristics of the output light of the SLD system with different optical feedback ratios by the Michelson interferometer. The measured value of temporal coherence length is almost identical to the theoretical value predicted from the output spectrum. Furthermore, we also observe the long-scan-range interference patterns. The interference pattern with the one by one wave packets due to the Fabry-Perot modulation of SLD can be obtained. The distance between two adjacent wave packets is related to the length of the SLD device, the effective refractive index of the gain medium, and the temporal coherence or spectral width of the output light, which is dependent on the optical feedback ratio.

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