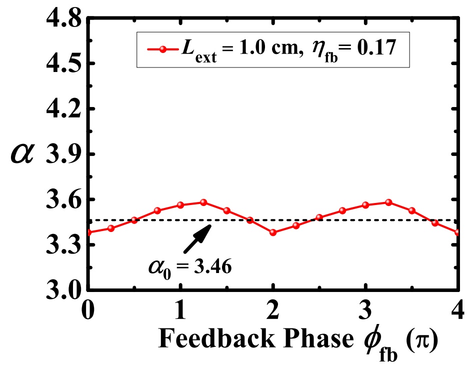

Fig. 6. α obtained experimentally with $\eta_{fb} = 0.17$ and $L_{ext} = 1.0$ cm, where α suppressed below its free-running value is demonstrated.

current setup. As can be seen, when varying the ϕ_{fb}, α dropped below its free-running value is demonstrated. To further lower α, integrating a phase control unit to shorten L_{ext} is required.

5. Conclusions

In conclusion, we study the variation of the linewidth enhancement factor α for a semiconductor laser subject to optical feedback and show a way of controlling it. By monitoring the turning point of the Hopf bifurcation curve at its minimum detuning with optical injection, α of the semiconductor laser under different feedback conditions are measured. The influences of the feedback strength, external cavity length, and feedback phase are examined. For both the long cavity and short cavity regimes, α is found to increase with the feedback strength in the moderate feedback region chosen due to the undamped relaxation oscillation. Moreover, while it is shown to be phase insensitive in the long cavity regime, it can be tuned continuously in the short cavity regime by varying the feedback phase.

The phenomenon demonstrated in this paper can be useful in controlling the chirp of an integrated compact device with the aid of phase control. From the simulation results, a wide tuning range of α is expected with an external cavity in the millimeter or sub-millimeter range. While α for different quantum-dot semiconductor lasers studied vary in a much larger range compared to the quantum-well ones [19], α of the quantum-dot semiconductor lasers subject to various optical feedback conditions will be further investigated.

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