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## Effect of the frequency detuning on the stability analysis in a semiconductor laser subject to optical injection: Hopf and Routh-Horwitz conditions

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### Abstract

In this paper, the rate equations for a laser diode subject to an optical injection are studied both analytically and numerically. By determining the Hopf and Routh-Hurwitz conditions, the stability boundaries of the laser system have been studied. The stability diagrams have been discussed in terms of detuning and the injection rate for different values of the linewidth enhancement factor. Also, we obtain critical relations for the Hopf points that lead to instability in the laser system. It has also shown that obtained relations depend on four parameters: detuning, linewidth enhancement factor, optical injection strength and pumping current.

**Keywords:** stability analysis, semiconductor laser, Hopf point, Routh-horwitz, frequency detuning, optical injection

For full article, refer to the Persian section