TUNABLE PHOTONIC OSCILLATORS

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Limit Cycle oscillators are used to model a broad range of periodic nonlinear phenomena. Using the optically injected semiconductor oscillator as a paradigm, we have demonstrated that at specific islands in the optical frequency detuning and injection level map, Period One Limit Cycle oscillation frequency is simultaneously insensitive to multiple perturbation sources. In our system these include the temperature fluctuations experienced by the master and slave lasers as well as fluctuations in the bias current applied to the slave laser. Tuning of the oscillation frequency then depends only on the injected optical field amplitude. Experimental measurements are in good quantitative agreement with numerical modeling and analysis based on a reduced Adler}} phase dynamics type equations. These special operating regions should prove valuable for developing ultra-stable nonlinear oscillators, such as sharp linewidth, frequency tunable photonic microwave oscillators. Finally the concept of an Isochron originally developed in mathematical biology will be reviewed and placed on context for efficient design of stable frequency sources in systems of optically coupled limit cycles oscillators [1,2].

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