Excitability of lasers with integrated dispersive reflector

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Abstract

This paper is concerned with the phenomenon of excitability in semiconductor lasers consisting of a DFB section and a passive dispersive reflector (PDR). We assume that the PDR section contains a Bragg grating and/or a passive Fabry- Perot filter guaranteeing a dispersive reflection of the optical field. We investigate a single mode model for PDR lasers and derive conditions under which excitable behavior can be demonstrated. Especially, we show the existence of a threshold, that is, only perturbations above the threshold imply a large excursion from the steady state, and where the response is almost independent of the strength of the perturbation; moreover we establish the existence of a refractory period, i.e., if a second perturbation is applied before the refractory time has passed, then the system does not respond.