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Semiconductor ring laser with filtered optical feedback: traveling wave description and experimental validation

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Abstract

We study experimentally and theoretically a semiconductor ring laser with four filtering channels providing filtered delayed optical feedback. To describe and analyze the wavelength selection and tuning in this device, we exploit the traveling-wave model determining the evolution of optical fields and carrier density along the ring cavity and filtering branches. The numerical results agree with the experimental observations: we can reproduce the wavelength tuning, the multiple wavelength emission, and the wavelength switching speed measured in these devices. The traveling-wave model allows us to study in detail the effect of the different laser parameters and can be useful for designing future devices.