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Dynamical regimes of a multistriple laser array with external off-axis feedback

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Abstract

We theoretically study the dynamics of a multistriple laser array with an external cavity formed by either one or two off-axis feedback mirrors, which allow us to select a single lateral supermode with transversely modulated intensity distribution. We derive and analyze a reduced model of such an array based on a set of delay differential equations, taking into account transverse carrier grating in the semiconductor medium. With the help of the bifurcation analysis of the reduced model, we show the existence of single and multimode instabilities leading to periodic and irregular pulsations of the output intensity. In particular, we observe a multimode instability leading to a periodic regime with antiphase oscillating intensities of the two counter-propagating waves in the external cavity. This is in agreement with the result obtained earlier with the help of a 2+1 dimensional traveling wave model.