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Pulse Shaping and Optical Bistability in NH_3 Gas Inside a Fabry-Perot Cavity.

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Abstract

We have studied theoretically, the dynamic behavior of a fabry-perot interferometer filled with ammonia gas (as a nonlinear medium) pumped with SLM-TEA CO_2 laser based on the work of Bischofberger and Shen. The transient to quasi-steady state modes are considered. output pulse distortion as well as optical bistability are possible to occur. In the steady state mode the device might be driven to some kind of chaotic (turbulent) state.

Introduction

The transmitted light by a fabry-perot cavity containing a two level system exhibits a bistable behavior [1, 2]. This phenomena is usually called by the name optical bistability, and its originates from the saturation of the absorption by the two level absorber (absorption optical bistability) [1] or from the cooperation between the cavity mistuning and the nonlinear dispersion of the absorber (the dispersive bistability),[1]. From the theoretical point of view the optical bistability is interesting since it can be considered as a typical example of a first order like phase transition in a system far from thermal equilibrium. On the other hand optical bistable devices are able to perform optically controlled memory and switching operations [3]. Consequently, they may be key components in successful all optical systems. Already, optical bistability has been observed using a wide variety of nonlinear materials, and many all-optical devices have been demonstrated : memory, limiter, ac-amplifier, oscillator, gate, modulator and discriminator.

The self induced index changes in optical media can lead to pulse distortion which is the first indication of bistability. [4] The mechanisms behined self induced index changes fall into two basic categories. In the first category are several nonres onent mechanisms which have been