Nasir Ganikhodjaev
Farrukh Mukhamedov
Pah Chin Hee

VOLUME 1

$$x' = 2xy$$
$$y' = 2xz$$

INVESTIGATIONS ON PURE MATHEMATICS, FINANCE MATHEMATICS AND OPTICS

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$$\varphi_1(x, y, z) = z$$

$$z' = x^2 + y^2 + z^2 + 2yz$$

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Investigations on Pure Mathematics, Finance Mathematics and Optics

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Part II Finance Mathematics Concentration

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MATRIX METHODS OF OPTICAL RESONATORS

Siti Aminah Mohd Mansor
Assoc. Prof. Dr. Bakhram Umarov

Abstract. *One of the pleasant surprises of modern optics is that the geometrical ray transfer method can be adapted to describe the propagation of laser beam. The ray transfer matrix, often called the ABCD matrix is a two-by two matrixes with two independent parameters. In a meantime, optical resonator consists of two spherical mirrors separated with a distance; d is a major part of laser. This study examines the use of ray transfer matrices for optical resonators as well as discussing about the stability criterion of resonators and the example of stable resonators. Only certain values of radius and length of resonator will produce stable resonator.*

1 Introduction of Optical Resonators

Resonator consists of two mirrors of radii R_1 and R_2 separated with a distance, d. The most widely used laser resonators have either planes or spherical mirrors. The mirror material absorbs some amount of ray and the surface of the mirror is also scatters some amount of ray. This is what we call as refraction and reflection of ray. According to Ting & Taegeun (2006), for sustained oscillations, implying a constant laser output, the resonator must be stable. In stable resonators, a light ray must keep bouncing back and forth and remain trapped inside.

In stable resonators, a light ray must keep bouncing back and forth and remain trapped inside. Figure 1.1 below shows the resonator with two spherical mirrors meanwhile Figure 1.2 shows the ray tracing of stable and unstable configuration.

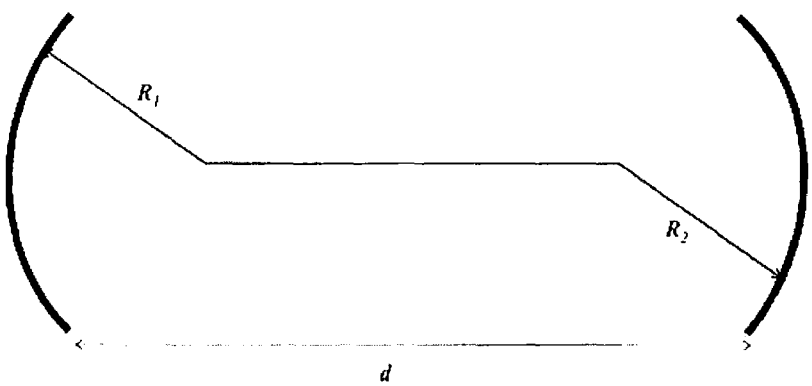

Figure 1.1. Resonator with two spherical mirrors.

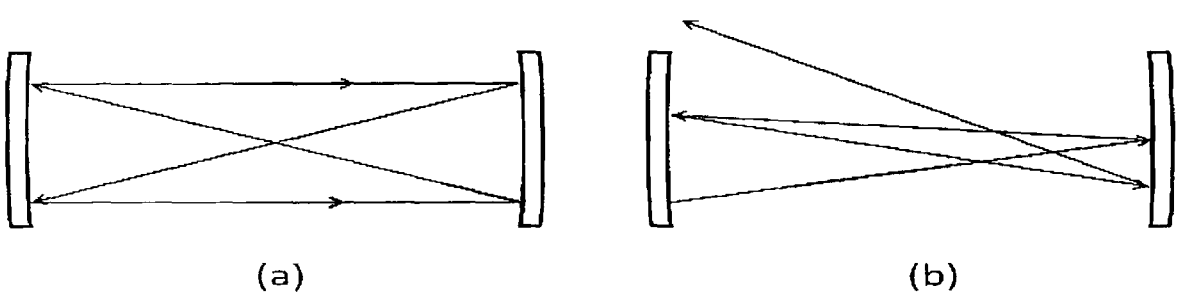

Figure 1.2. (a) A ray bouncing between two curved mirrors in a stable configuration. (b) A ray bouncing between two curved mirrors in an unstable configuration.