

# Optical Communications Lab

## Experiment 6

Wolfgang Heni  
Sebastian Heunisch

Institute of Photonics and Quantum  
Electronics

Tutor: Jingshi Li

15. June 2011

# 1. Preparation

## 1.1 Design of an awesome resonator

## 1.2 Measuring the Resonator Parameters

To characterize a resonator its power transmission in dependency of the frequency can easily be measured. By that measurement, the width of the resonance lines at full width half maximum (FWHM)  $\delta f$  and the free spectral range  $\Delta f$  can be determined. (cf. figure ??). The quotient  $F = \Delta f / \delta f$  is called Finesse. For the case of critical coupling  $F$  is given as:

$$F = \frac{\Delta f}{\delta f} = \frac{\pi \sqrt{1 - \kappa}}{\kappa} = \frac{\pi \exp(-\alpha/2L)}{1 - \exp(-\alpha/L)} \quad (1.1)$$

This can be rearranged to:

$$\kappa = 0.5 \pm \sqrt{0.25 + F^2/\pi^2} \quad (1.2)$$

and

$$\alpha = -\frac{\ln F}{L(\ln F + 2 \ln \pi)} \quad (1.3)$$

respectively.

## 1.3 Over-Critical and Under-Critical coupling

## 2. Experiment