OPTIMAL MICROSTRIP BENDS

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Introduction

this work presents two compensation techniques for the discontinuities of a 90° right angle microstrip bend

direct optimization is applied to achieve an optimal structure, which minimizes the effect of the discontinuities

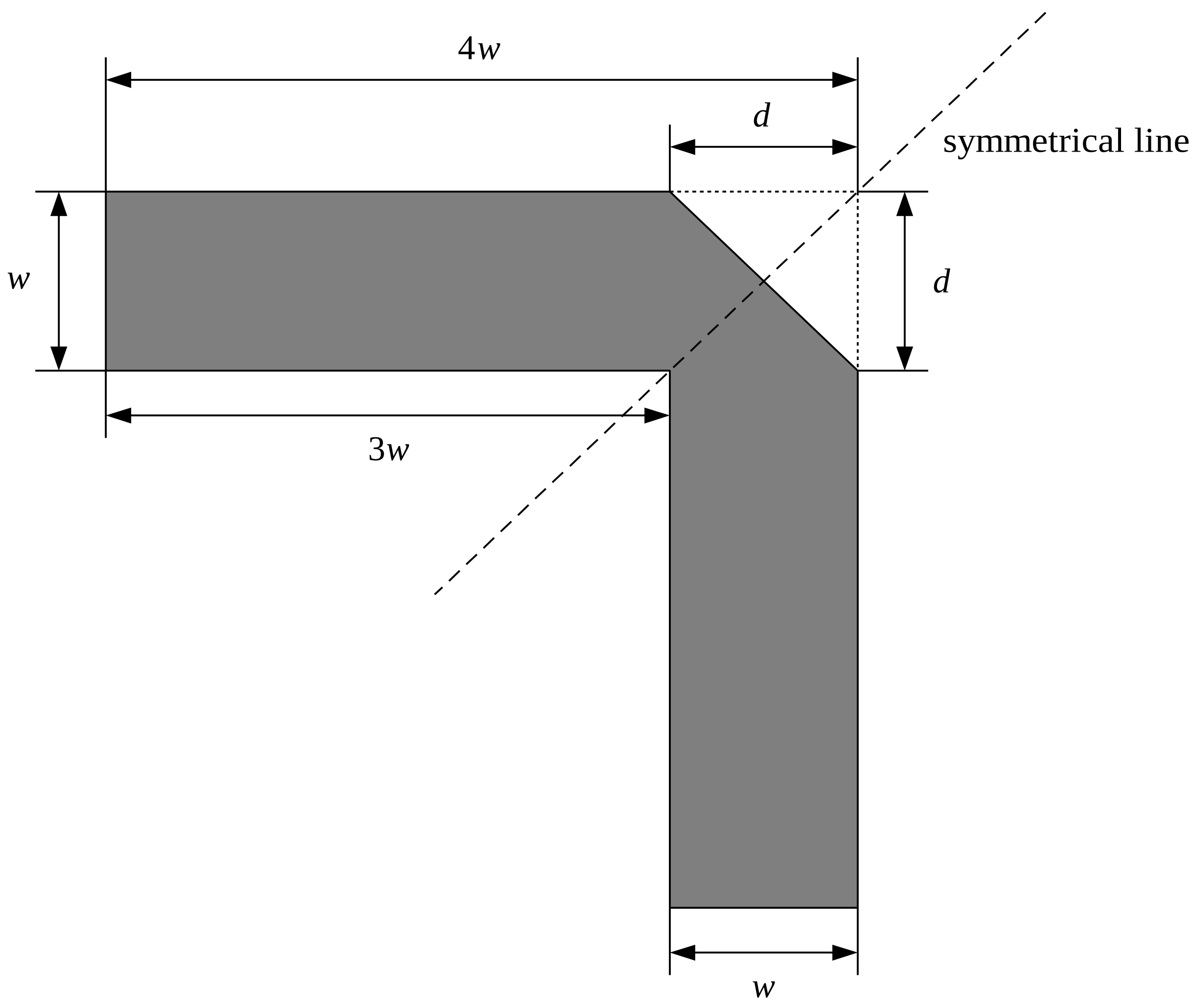
in this work, the goal of optimization is to minimize the reflection at each port

the bends considered here are symmetrical and are connected to 50 ohm impedance at each port

OSA90/hope, Empipe and Sonnet ***em*** are used as the optimization and simulation tools

Introduction

the configurations in Fig. (1) and Fig. (2) present two compensation techniques (E. H. Fooks, R. A. Zakarevicius, "*Microwave Engineering Using Microstrip Circuits*", Prentice Hall, 1990)



$w = 15$ mil, h (height of substrate)=15 mil and $e_r = 9.8$

Fig. 1 a mitered bend

Introduction

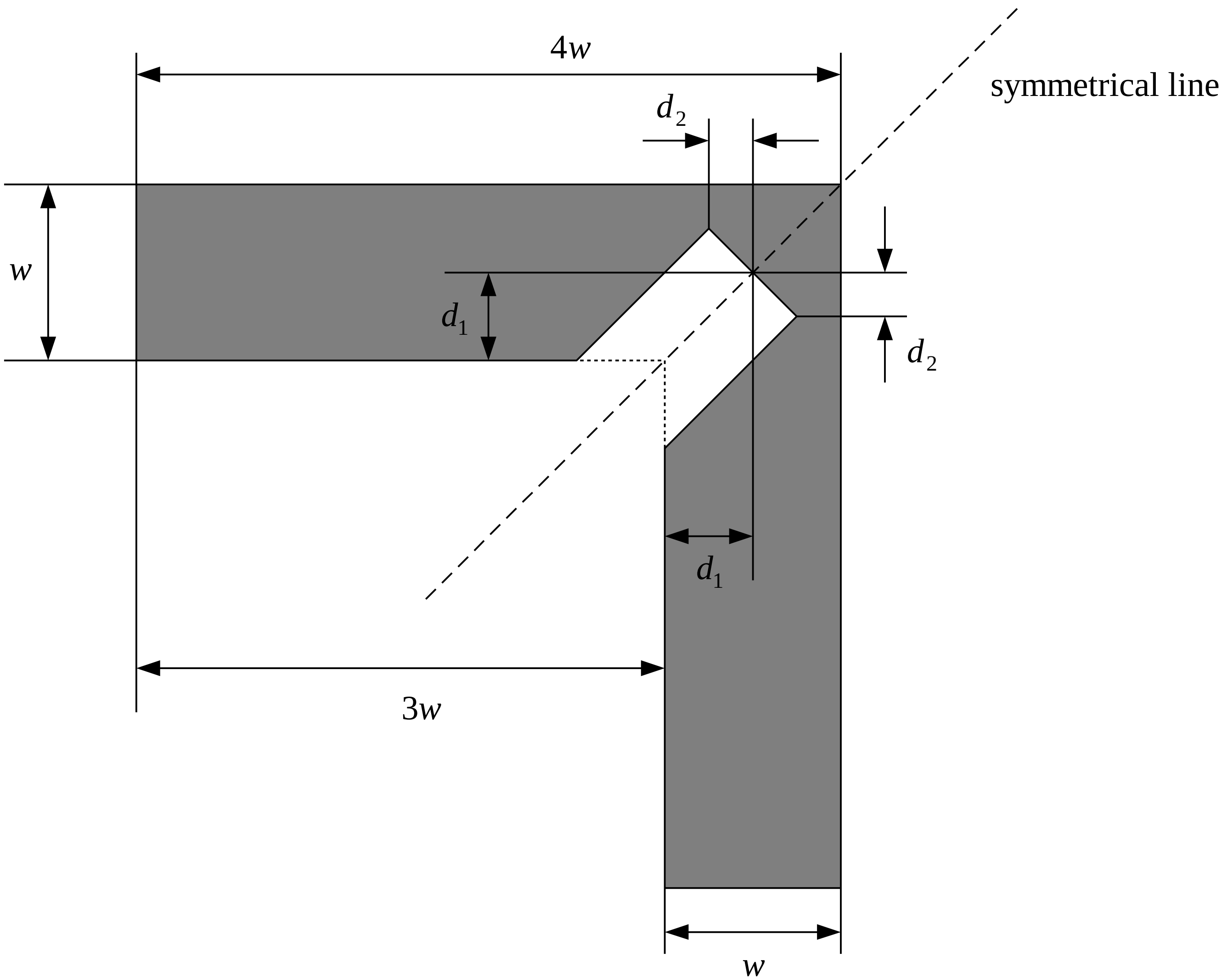


Fig. 2 a bend with a slit

Design Specifications

zero is the ideal value of magnitude of the reflection coefficient at each port

the design specification used here is

MS11=0
From 18 GHZ to 30 GHZ, step=3 GHZ

Optimization Results

for the compensation technique shown in Fig. 1, d is the optimization variable

the optimal solution is $d = 1.3103\, w$

the optimal response of $|S_{11}|$ is shown in Fig. 3 together with $|S_{11}|$ of the basic 90° right angle bend for comparison

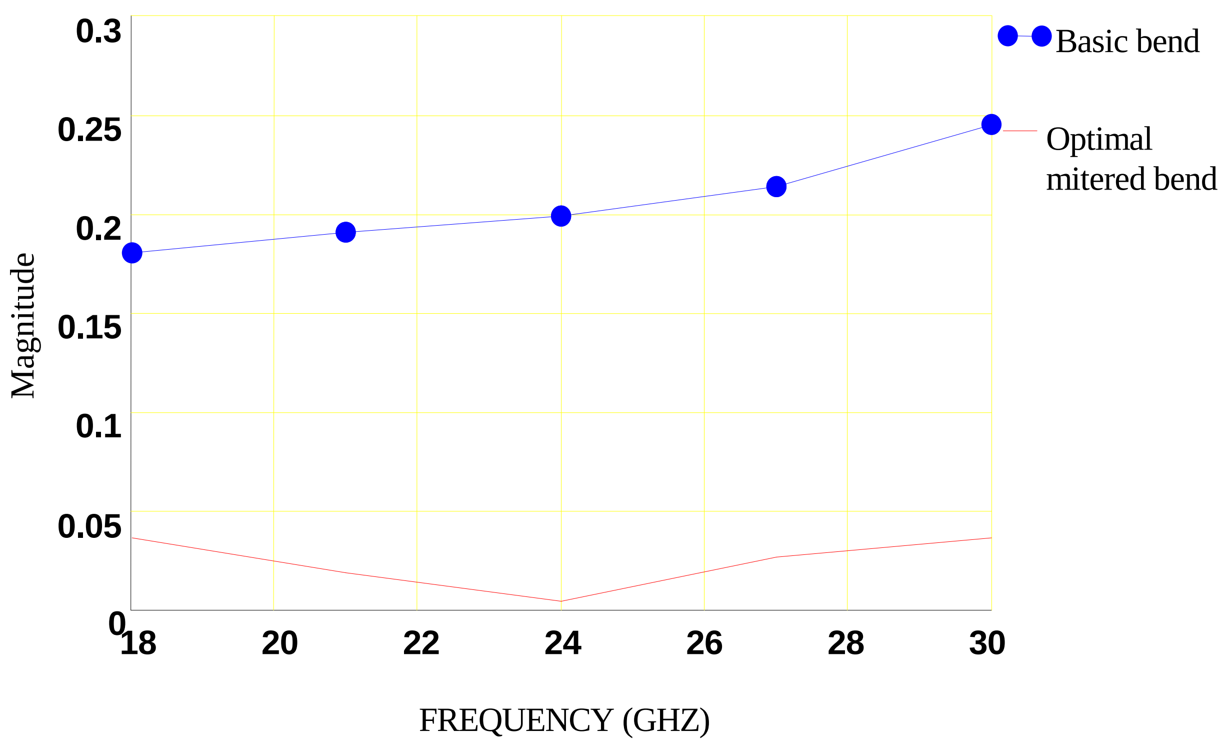


Fig. 3 $|S_{11}|$ for the basic 90° right angle microstrip bend and the optimal mitered bend in Fig. 1

Optimization Results

for the compensation technique shown in Fig. 2, the optimization variable is d_1 at d_2 equal to 1 mil, 2 mil

the optimal values of d_1 were given in Table I

$|S_{11}|$ at the optimal value of d_1 for d_2 equal to 1 mil and 2 mil is shown in Fig. 4

$|S_{11}|$ of the basic 90° right angle microstrip bend without any compensation is also shown in Fig. 4 for comparison

Table I

d_2 (mil)	The optimal value of d_1 (mil)
1	8.11025
2	6.17696

Optimization Results

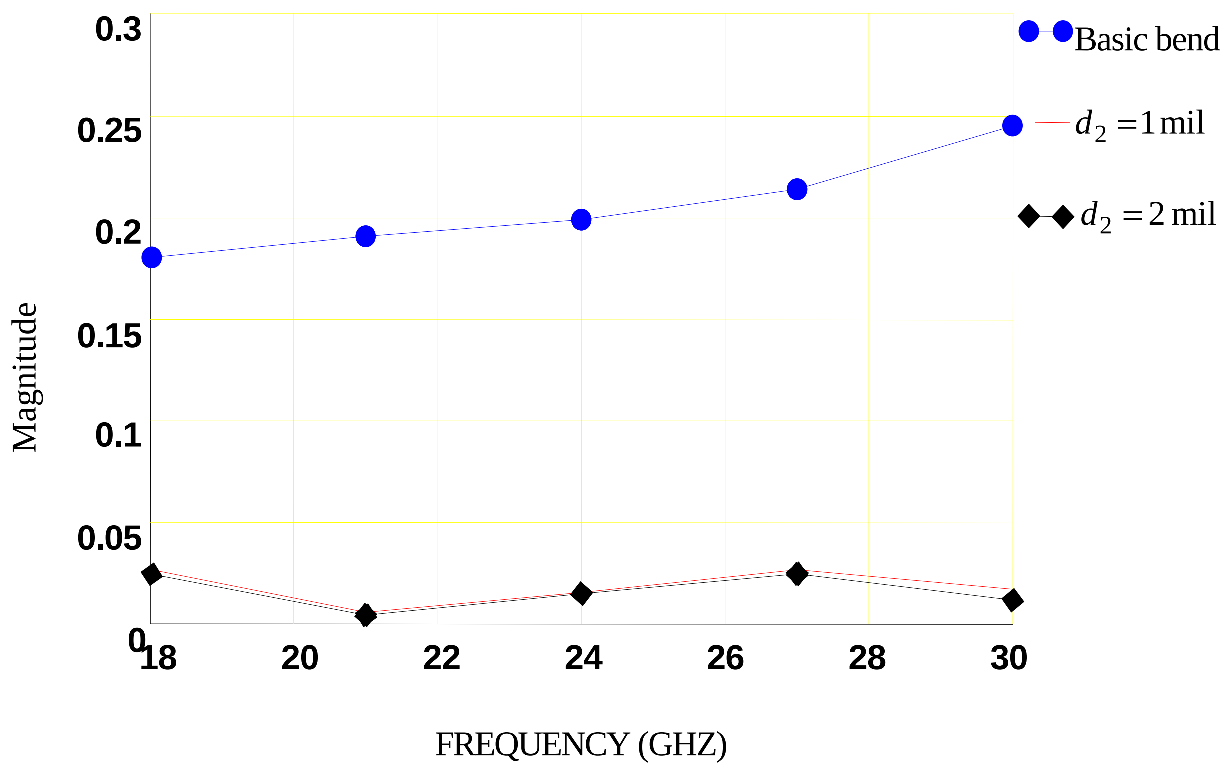


Fig. 4 $|S_{11}|$ for the basic 90° right angle microstrip bend and the optimal bend in Fig. 2 with d_2 equal to 1mil and 2 mil

Optimization Results

Fig. 5 shows $|S_{11}|$ in the frequency range 18 GHz to 30 GHz for the optimal structures of the two configurations and the basic 90° right angle microstrip bend

it is noted that the optimal bends give good response

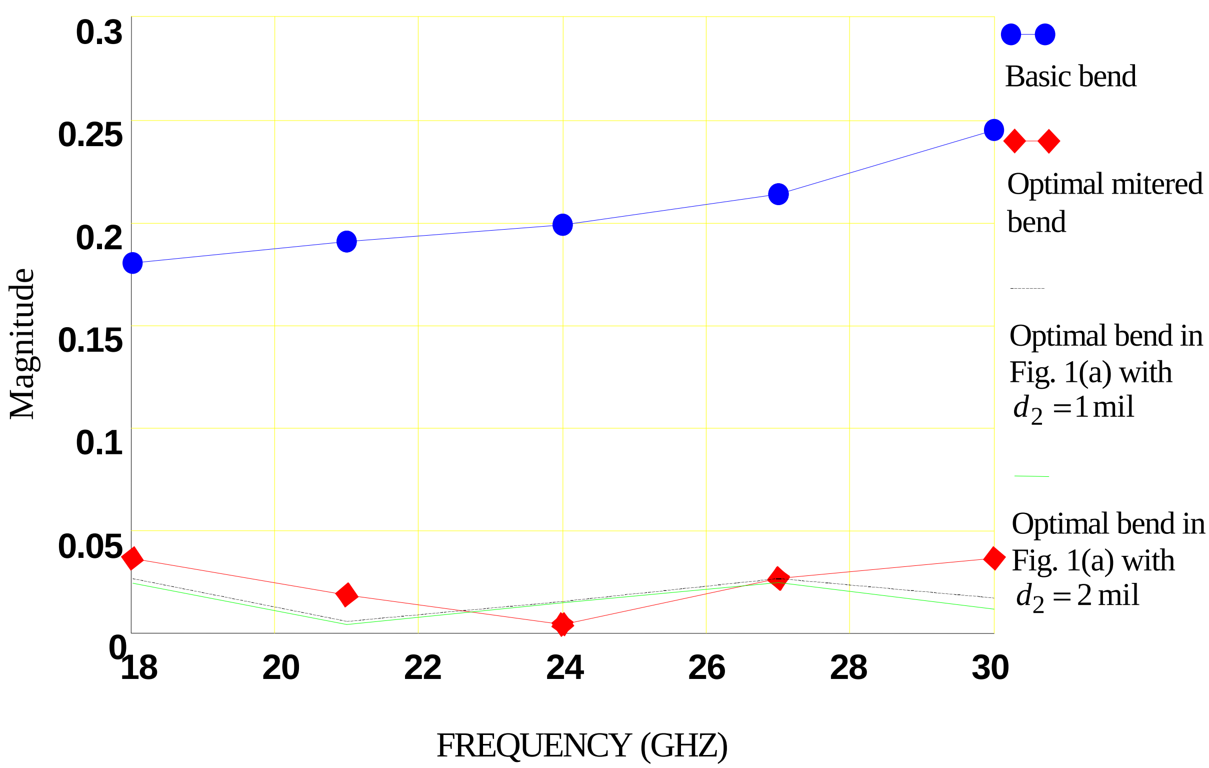


Fig. 5 $|S_{11}|$ for the basic 90° right angle microstrip bend and the optimal bends shown in Fig. 1 and Fig. 2

Conclusions

two compensation techniques are applied to a 90° right angle microstrip bend

the performance of the two techniques is optimized by direct optimization with Sonnet ***em*** and Empipe

both of the two techniques can noticeably reduce the reflection at each port