## Contents

Preface						
Contents						
1	Review of mathematical notation and functions					
	1.1	Numbers	1			
	1.2	Functions	2			
	1.3	Calculus	6			
	1.4	Notation	7			
2	Physical sound					
	2.1	What is sound?	9			
	2.2	Simple harmonic motion	13			
	2.3	Complex harmonic motion	19			
	2.4	Harmony, periodicity, and perfect intervals	22			
	2.5	Properties of waves	27			
	2.6	Chapter summary	46			
3	Musical sound					
	3.1	Rhythm	49			
	3.2	Pitch	51			
	3.3	Tuning and temperament	52			
	3.4	Timbre	62			
	3.5	Chapter summary	66			
4	Musical instruments					
	4.1	The piano	67			
	4.2	The viol family	71			

	4.3	Woodwinds and brasses	77		
	4.4	Drums	89		
	4.5	Electric guitars and effects units	93		
	4.6	Chapter summary	104		
5	Auditory perception				
	5.1	Physiology of the ear	109		
	5.2	Psychoacoustics	116		
	5.3	Perfect pitch	129		
	5.4	Chapter summary	133		
6	Digital audio basics				
	6.1	Sampling	138		
	6.2	Compression	150		
	6.3	Chapter summary	158		
7	The discrete Fourier transform				
	7.1	The Fourier series	161		
	7.2	Euler's formula	167		
	7.3	The discrete Fourier transform	172		
	7.4	The DFT, simplified	190		
	7.5	Examples	198		
	7.6	Chapter summary	210		
8	Other Fourier transforms				
	8.1	Discrete-time Fourier transform (DTFT)	214		
	8.2	Fast Fourier transform (FFT)	216		
	8.3	Short-time Fourier transform (STFT)	221		
	8.4	Chapter summary	227		
A	Frequency-selective circuits				
	A.1	Ohm's Law	231		
	A.2	Filtering	235		
	A.3	The $Z$ -transform	239		

	A.4	Chapter summary	249		
В	B Using computers to do Fourier transforms				
	B.1	Matlab	251		
	B.2	Mathematica	256		
	B.3	$C \ldots \ldots$	260		
References					
Glossary					
Index					