

Table of Contents

1	Simulating the Transmission Behavior of Electrical Circuits	3
1.1	Calculation of the Transfer Function $H(\omega)$	7
1.2	Dimensions of High- and Low-Pass Filters	13
1.3	Locus Curves	18
1.4	Bode Diagram	19
2	Simulating the Time Behavior of Electrical Circuits	23
2.1	Physical Laws of Construction Elements	24
2.2	Setting up the DEq of a Circuit	24
2.3	Solving the DEq with Euler's Method	25
2.4	Examples with L , C , and R	27
2.5	Modelling and Simulation of Filter Circuits	30
2.6	Simulation of the Low-Pass LP2PiCLC	32
3	Simulating Mechanical Systems with Mass Points	37
4	Simulating the Motion of Charged Particles in Electromagnetic Fields	45
5	Analysis of Periodic Signals: Fourier Series	51
5.1	Analysis of 2π -periodic Signals	52
5.2	Fourier Series for p -periodic Signals	57
5.3	Complex-valued Fourier Series	62
5.4	Analysis of Periodic Signals (Simulations)	64
6	Analysis of Non-Periodic Signals: Fourier Transform	69
6.1	Fourier Transform and Interpretation	69
6.2	Properties of the Fourier Transform	74
6.3	Fourier Transform of the Delta Function	81
7	Analysis of Discrete Signals: DFT	87
7.1	Basic Concept	87
7.2	Properties of the DFT	89
7.3	Inverse Discrete Fourier Transform	91
7.4	Calculation of the DFT	93

8	Simulating Discrete Signals: FFT	99
8.1	Dependence of Spectral Range on Number of Samples	99
8.2	Hanning Window	101
8.3	The plot_fft Procedure with the Hanning Option	102
8.4	Maximum Detectable Frequency	104
8.5	Frequency Resolution	105
8.6	Analysis of Measured Data	107
9	Analysis of Linear Systems	111
9.1	LTI Systems	111
9.2	Impulse Response	113
9.3	The System Function (Transfer Function)	116
9.4	Relation between Step and Delta Function	119
9.5	Simulation of the Transmission Behavior	122
10	Simulating Linear Systems	129
10.1	Discrete Frequency Analysis of a Low-Pass	130
10.2	Frequency Analysis of the Double Pendulum System	133
A	Introduction to the Maple User Interface	139
A.1	Basics about the User Interface of Maple	139
A.2	More Support on Maple Input	142
A.3	Maple Structures	145
A.4	Maple's Help	146
B	Maple Examples	149
	Index	155