

Integral and discrete transforms

Complex function of complex variable (approx. 2 lectures)

- basic operations, functions $\exp(z)$, $\sin(z)$, $\cos(z)$, ... p. 1
- derivative, analytic function, Cauchy-Riemann equations ... p. 7
- line integral, Cauchy theorem, Cauchy integral formula ... p. 10
- Taylor expansion of analytic function ... p. 16
- Laurent expansion, singular points, residue theorem ... p. 21

Laplace transform (approx. 3 lectures)

- basic properties ... p. 30
- inverse Laplace transform ... p. 43
- solution of problems for ODEs and PDEs with Laplace transform ... p. 50

Discrete Laplace and Z transform (approx. 2 lectures)

- basic properties ... p. 78
- inverse transform ... p. 83
- solution of difference equations with Z transform ... p. 91

Fourier series (approx. 2 lectures)

- introduction, basic theory ... p. 107
- examples ... p. 120
- solution of ODEs with periodic right hand side ... p. 134
- solution of PDEs by Fourier method ... p. 140
- extension for non-periodic functions, Fourier integral ... p. 146

Fourier transform (approx. 2 lectures)

- definition ... p. 148
- amplitude spectra of non-periodic function ... p. 151
- signal filtering ... p. 157
- solution of problems for ODEs and PDEs ... p. 166
- discrete Fourier transform (DFT) ... p. 171
- fast Fourier transform (FFT) ... p. 205

Modern transforms for processing of real time signal (approx. 1 lecture)

- windowed Fourier transform ... p. 206
- wavelet transform ... p. 210
- Hilbert transform ... p. 222
- Hilbert-Huang transform ... p. 228