

PP. MRiT. Gas technology, renewable energy
Summer semester of the academic year 2017/18
Applied mathematics and mathematical methods
2018-06-20 Exam problems

1. Float-point arithmetics
2. Classical probability, geometrical probability. Bertrand paradox
3. Binomial theorem $(a+b)^r$ with a natural r (and Pascal triangle), and with a real r
4. Polynomial collocation in both natural/standard/Stevin and Lagrange bases
5. Trigonometrical collocation, e.g., in the basis $1, \cos t, \sin t, \dots, \cos(mt), \sin(mt)$
6. Collocation in the Euler(ian) basis $1, \exp(it), \exp(2it), \dots, \exp(mit)$
7. Bit reversing, butterfly glue, and the idea of FFT
8. The polynomial least-square fit, aka the method of least squares
9. An eigenpair of a matrix and its geometrical (via M -images), mechanical and computation interpretations, a characteristic equation
10. An equivalence relation, its examples (incl. the similarity of matrices)
11. The theorem on characteristic polynomials of similar matrices, the theorem on how big the spectrum of a matrix is
12. The diagonalization of a matrix having the full spectrum
13. The Cayley-Hamilton theorem and its consequence to calculation of the matrix exponential
14. A real function, f , calculated for a matrix argument, M , and the Lagrange-Sylvester theorem concerning $f(M)$
15. The equation covering an exponential growth, as well as the discharge of a capacitor
16. The Newton cooling problem
17. The equation describing the movement of a mass on a spring, as well as the flow of the current along (both serial and parallel) RLC circuit
18. System of HLODE1CC (homogeneous linear ordin.different.eqns of order 1 with constant coefficients) and its solving via the matrix exponential
19. Basic LPDE2: the heat transfer eqn, the string/wave eqn, the Laplace eqn
20. The spectral recognition of types of LPDE2 in two (and more) variables

{15 lecture hours, 15 class hours}

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