

# Approximation Theory and Approximation Practice

*Extended Edition*

**Lloyd N. Trefethen**

*University of Oxford  
Oxford, United Kingdom*

**siam.**

Society for Industrial and Applied Mathematics  
Philadelphia

# Contents

Preface to the Extended Edition	ix
1. Introduction	1
2. Chebyshev Points and Interpolants	7
3. Chebyshev Polynomials and Series	13
4. Interpolants, Projections, and Aliasing	25
5. Barycentric Interpolation Formula	33
6. Weierstrass Approximation Theorem	43
7. Convergence for Differentiable Functions	49
8. Convergence for Analytic Functions	55
9. Gibbs Phenomenon	63
10. Best Approximation	73
11. Hermite Integral Formula	81
12. Potential Theory and Approximation	89
13. Equispaced Points, Runge Phenomenon	95
14. Discussion of High-Order Interpolation	103
15. Lebesgue Constants	107
16. Best and Near-Best	117
17. Orthogonal Polynomials	123
18. Polynomial Roots and Colleague Matrices	133
19. Clenshaw–Curtis and Gauss Quadrature	143
20. Carathéodory–Fejér Approximation	155
21. Spectral Methods	165
22. Linear Approximation: Beyond Polynomials	177
23. Nonlinear Approximation: Why Rational Functions?	189
24. Rational Best Approximation	199
25. Two Famous Problems	209
26. Rational Interpolation and Linearized Least-Squares	221
27. Padé Approximation	235
28. Analytic Continuation and Convergence Acceleration	251
Appendix A: Six Myths of Polynomial Interpolation and Quadrature	263
Appendix B: “ATAP for Periodic Functions” ( <i>SISC</i> 2015)	273
Appendix C: “ATAP for the Unit Disk” ( <i>SINUM</i> 2014)	297
References	329
Index	357