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This book gives a thorough and coherent introduction to the theory that is the basis of current approximation methods. Professor Powell describes and analyses the main techniques of calculation supplying sufficient motivation throughout the book to make it accessible to scientists and engineers who require approximation methods for practical needs.

A survey of classical techniques in Approximation Theory. The class will follow the outline below, touching on each major topic in a depth that will be determined by the pace of the class. Approximation Theory and Methods by Powell will be used as the main textbook for the class, with the following chapters covered: The approximation problem and existence of best approximations; Ch. The uniqueness of best approximations; Ch. Approximation operators and some approximating functions; Ch. The uniform convergence of polynomial approximations; Ch. The theory of minimax approximation; Ch. Least squares approximation; Ch. Properties of orthogonal polynomials; Ch. Approximation of periodic functions; Ch. The order of convergence of polynomial approximations; Ch. The uniform boundedness theorem; Ch. Interpolation by piecewise polynomials; Approximation of Functions by Lorentz is more advanced. A brief review of the following chapters will be presented if time allows: Polynomials of Best Approximation; 1. Existence of polynomials of best approximation; 2. Characterization of polynomials of best approximation; 3. Applications of convexity; 4. Uniqueness of polynomials of best approximation; 6. Properties of Polynomials and Moduli of Continuity: Inequalities of Bernstein; 3. The inequality of Markov; Finally, the book An Introduction to the Approximation of Functions by Rivlin is recommended for independent reading, in particular: Polynomial and Spline Interpolation.

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Multiscale Poisson intensity and density estimation by R. TH , " The nonparametric Poisson intensity and density estimation methods studied in this paper offer near minimax convergence rates for broad classes of densities and intensities with arbitrary levels of smoothness. The methods and theory presented here share many of the desirable features associated with The methods and theory presented here share many of the desirable features associated with waveletbased estimators: At the heart of these methods lie multiscale decompositions based on free-knot, free-degree piecewise-polynomial functions and penalized likelihood estimation. The degrees as well as the locations of the polynomial pieces can be adapted to the observed data, resulting in near minimax optimal convergence rates. For piecewise analytic signals, in particular, the error of this estimator converges at nearly the parametric rate. These methods can be further refined in two dimensions, and it is demonstrated that platelet-based estimators in two dimensions exhibit similar near-optimal error convergence rates for images consisting of smooth surfaces separated by smooth boundaries. Smith, Mac Schwager, Daniela Rus , " We present controllers that enable mobile robots to persistently monitor or sweep a changing environment. The changing environment is modeled as a field which grows in locations that are not within range of a robot, and decreases in locations that are within range of a robot. We assume that the rob We assume that the robots travel on given closed paths. The speed of each robot along its path is controlled to prevent the field from growing unbounded at any location. We consider the space of speed controllers that can be parametrized by a finite set of basis functions. For a single robot, we develop a linear program that is guaranteed to compute a speed controller in this space to keep the field bounded, if such a controller exists. Another linear program is then derived whose solution is the speed controller that minimizes the maximum field value over the environment. We extend our linear program formulation to develop a multi-robot controller that keeps the field bounded. The multi-robot controller has the unique feature that it does not require communication among the robots. Simulation studies demonstrate the robustness of the controllers to modeling errors, and to stochasticity in the environment. Abstractâ€”Extended objects are characterised with multiple measurements originated from different locations of the object surface. This paper presents a novel Sequential Monte Carlo SMC approach for extended object tracking based on border parametrisation. The problem is formulated for general nonl The problem is formulated for general nonlinear problems. The main contribution of this work is in the derivation of the likelihood function for nonlinear measurement functions, with sets of measurements belonging to a bounded region. Simulation results are presented when the object is surrounded by a circular region. Accurate estimation results are presented both for the object kinematic state and object extent. A complex and multimodal pdf can be represented by mixtures of Gaussians as shown in [10]. We introduce k,l -regular maps, which generalize two previously studied classes of maps: We exhibit some explicit examples and obtain bounds on the least dimension of a Euclidean space into which a manifold can be embedded by a k,l -regular map. The problem can be regarded as an extension of embedding theory to embeddings with certain nondegeneracy conditions imposed, and is related to approximation theory. Thus, our curve is k, l -regular, just as we claimed. First, we observe that this map is k, l -regular in the complex sense, that is, that In this paper special possibly constrained problems of linear and nonlinear complex approximation are studied with respect to the existence and uniqueness of solutions and the convergence of the approximation errors, where the errors are measured by an arbitrary L p - and l p -norm respectively. The problems arise in connection with the frequency and magnitude response approximation at the design of nonrecursive digital filters in the frequency domain. Two main results of the paper concern the completeness of the functions exp ik! These results imply that, under usual assumptions and with increasing number of approximating functions exp ik! The Lanczos method is often used to solve a large and sparse symmetric matrix eigenvalue problem. There is a well-established convergence theory that produces bounds to predict the rates of convergence good for a few extreme

eigenpairs. These bounds suggest at least linear convergence in t These bounds suggest at least linear convergence in terms of the number of Lanczos steps, assuming there are gaps between individual eigenvalues. In practice, often superlinear convergence is observed. An affirmative answer is given here for the two extreme eigenvalues by examples whose Lanczos approximations have errors comparable to the error bounds for all Lanczos steps. Fast Evaluation of Zolotarev Coefficients by A. Kennedy , " Among all its solutions, the one which has the least norm is sought when Rn is equipped with a strictly convex norm. We present a globally convergent, iterative algorithm for We present a globally convergent, iterative algorithm for computing this solution. This algorithm takes into account the special structure of the problem. Each iteration cycle of the algorithm involves the solution of a similar quadratic problem with a modified objective function. Duality conditions for optimality are studied. Feasibility and global convergence of the algorithm are proved. Numerical results are included. Approximation Theory for Matrices by A. Kennedy A , " We explain how rational approximations can be applied to large sparse matrices efficiently by making use of partial fraction expansions and mu We explain how rational approximations can be applied to large sparse matrices efficiently by making use of partial fraction expansions and multi-shift Krylov space solvers. Show Context Citation Context The reason why matrix polynomials are cheap to evaluate is that they do not require explicit diagonalisation of the matrix.

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