One of the purposes of the new Series A of Mathematics of the previously general journal Revista de la Real Academia de Ciencias de Madrid is to publish special issues on different mathematical topics, where Spanish groups can have the opportunity of showing their present research and that of some international researchers in connection with them.

In this case our group of the University of Zaragoza has been invited to edit this special issue on Numerical Methods of Approximation Theory and Computer Aided Geometric Design. Here is a sample of different approaches to this field. A sign of how relevant is this selection is that at least one of the authors of each paper is an editor of one or more of the journals Numerical Algorithms, Advances in Computational Mathematics, Computer Aided Geometric Design, Annals of Numerical Mathematics,... and two of these authors, C. Brezinski and C. A. Micchelli are respectively editors-in-chief of the first two of those journals.

The motivation of the paper by S. Basu, M. S. Khan, C. A. Micchelli and P. Olsen comes from the problem of classifying high dimensional feature vectors arising in some statistical machine learning problems in the domain of speech, image and video processing. For example problems of automatic machine recognition of speech or a specific object in an image or an event in a video sequence. In fact the authors of this paper have recently organized (July 2002) a Nato Advanced Study Institute on Learning Theory and Practice, in Leuven (Belgium).

Orthogonal polynomials play a very important role in many mathematical problems, among them interpolation, approximation, numerical integration, acceleration of convergence, wavelets, ordinary differential equations,... C. Brezinski reviews in his contribution to this issue some of the formal generalizations of orthogonal polynomials and discusses their applications to Padé approximation, Krylov subspace methods for the solutions of systems of linear equations and convergence acceleration methods.

In Computer Aided Geometric Design a curve with some prescribed shape properties is constructed from a control polygon. Bézier curves were the origin of this theory, extensible to surfaces. Some recent results have bounded the distance between a Bézier curve and its control polygon purely in terms of differences of the control points. J. M. Carnicer, M. S. Floater and J. M. Peña have shown in their paper in this volume that this type of bound naturally extends to many curves used in geometric modeling.

A basic problem in multivariate polynomial interpolation is the identification of *simple* distributions of points such that one knows in advance that a Lagrange or Hermite interpolation problem on those points has a unique solution in a given space of polynomials. In the paper by J. M. Carnicer and M. Gasca a *natural lattice* is defined as the set of all intersection points of any set of different lines, allowing parallelism and multiple concurrence. A Hermite problem and an adequate space of polynomials are associated in a natural way using a Newton approach to prove the unisolvence of the problem.

The paper by T. N. T. Goodman presents some new results on properties of refinable measures and a survey on the asymptotically optimal time-frequency localization of refinable measures and associated wavelets.

Some applications to wavelet construction and filter design require solutions of the conjugate quadrature filter equation $|P(z)|^2 + |P(-z)|^2 = 1$ for all z in the unit circle, which are polynomials of some fixed degree. This and other problems on spline projections or interpolatory subdivision lead to consider a Bézout identity for polynomials whose least degree solutions are studied here by T. N. T. Goodman and C. A. Micchelli.

Computational techniques for solving polynomial Hermite interpolation extend quite naturally to interpolation by generalized polynomials spanned by extended Chebyshev systems. G. Mühlbach, author of many papers on generalized Newton and Aitken-Neville formulae and interpolation by rational functions

with prescribed poles, surveys these and other techniques in his contribution to this issue.

In the paper by M. Peternell and H. Pottmann a Euclidean metric, defined in the space of planes, is used to solve two problems of current interest in Computer Aided Geometric Design. The first one concerns the recognition and reconstruction of planar faces of an object from scanned data points. The second application deals with the approximation of a surface or point cloud by a developable surface.

A stationary subdivision scheme is an iterative way to construct a surface by computing a sequence of discrete functions defined on a nested sequence of finer and finer grids. Much interest in stationary subdivision operators came from their connection to wavelet analysis, in particular to refinable functions. T. Sauer presents here the most general situation of stationary vector subdivision with respect to an arbitrary expanding dilation matrix.

We thank very much the authors of all these papers for their kindness accepting the invitation to contribute.

M. Gasca