# Evaluation of an Expo-rational B-spline for the Scalable Subset of Its Intrinsic-parameter Set

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Expo-rational B-splines (ERBS) provide a convenient isogeometric representation of curves, surfaces, volume deformations and higher dimensional manifolds which can be used for both geometric modeling purposes in Computer Aided Geometric Design and for computational purposes in finite and boundary element analysis.
The derivative of an ERBS between the consecutive knots $t_k, t_{k+1} : t_k < t_{k+1}$ of a strictly increasing knot-vector is either identically zero or it is an expo-rational function (i.e., a function which is the exponent of a rational function taking negative values for $t : t_k < t < t_{k+1}$ and having poles at $t_k$ and $t_{k+1}$).
There is a set of parameters in the definition of ERBS which are being referred to as *the set of intrinsic parameters* of this ERBS. This name is justified by the fact that they influence the curvature of the graph of the ERBS between $t_k$ and $t_{k+1}$, and for an ERBS curve in 3 and higher number of dimension these parameters influence both the curvature and the torsion of this curve.
The purpose of the present paper, and its main new result, is the identification of the exact maximal subset of the set of admissible intrinsic parameters of ERBS for which all ERBS basis functions are obtained as dilations and translates of one 'scaled' ERBS. We coin this subset to be *the scalable subset of the intrinsic-parameter set* of ERBS. The scaled ERBS can be precomputed once and forever, and can be used for fast computation of ERBS-based geometric models. In our software applications we use iterative Romberg integration for the precomputing of the scaled ERBS but the use of other positivity-preserving quadratures, such as, e.g., Gaussian quadratures, is also of interest. All of these quadrature processes are very rapidly converging, because the integrand is infinitely smooth.