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On a selection of basis functions in numerical analyses of engineering problems

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SUMMARY

This paper presents the basic characteristics of the existing numerical procedures from the aspect of the selection of approximate solution basis functions for different technical problems. Given are the advantages of algebraic and trigonometric polynomials due to universality of vector spaces they are forming. It is also shown that spline functions have extreme advantages for the practice as a result of finiteness. At the same time, they show disadvantages because of the loss of universality due to limited smoothness. Basis functions, which maintain properties of universality and infinite differentiability, and at the same time retain the characteristics of practical application of splines, are Rbf - Rvachev's basis functions. The properties of these functions classify them between classical polynomials and spline functions; hence, they complete a set of elementary functions. Procedures for the calculation of Rbf functions are given together with their distribution for forming numerical solutions and an illustration of basic possibilities for their application in practice. The special attention is paid to finite functions Fupn(x) of C class which are the elements of an universal space UPn, containing also algebraic polynomials to the n-th degree. The paper also illustrates the determination and application of finite basis functions, also pertaining to C class, the linear combination of which can be used for the exact description of exponential and trigonometric functions.