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Highly Effective Computing Algebra

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Modern supercomputing includes vector and parallel data processing on the basis of Vector Systems (VS) with SIMD/MSIMD-architecture and Massive Parallel Systems (MPS) with MIMD-architecture respectively.

Only these data processing technologies are known to provide maximum possible computational performance needed for solving many modern complex problems. However they are nowadays too expensive and are characterized as having the technology of programming, quite specific and laborious in mastering and usage. Thus the applied software that exists now and is worked out for classical monoprocessor and symmetrical multiprocessor systems can not be used for VS and MPS.

Within this project non-traditional computer technology of data representing and processing that lets escape the mentioned above drawbacks is suggested. It is developed on the basis of classic number theory and in particular some results of fundamental research of Russian academicians Chebyshev and Vinogradov [1]. Specific of proposed technology is determined by using mixed number system and special polynomial conversions. Some moments regarding this specific had been described in [2,3].

This technology might be realized by special software or special hardware (as coprocessor for existing computers as well as separate processor). In the first case executing all of algebraic procedures on numbers of any length reduces to processing data of length not more than length of computer word (that is, 16, 32, or 64 bits) and,in the second case, to processing data with length of 4,5 bits.

Besides multiplying of polynomials with sizes of N could be reduced to N multiplications (instead of N**2).

It lays in using the principle of highest possible parallelism in representing and processing the information with any practically used precision on

the level of algebraic operations with fixed and floating point. This point of view is based on some foundations of highest mathematics and in particular polynomial calculation.

The computer technology proposed could provide highly effective and reliable solving such modern and complex problems as systems of linear algebraic and differential equations of large sizes, vector-matrix processing, signal digital processing, harmonic analysis, linear programming, the Monte Carlo method, whole number processing, image and graphic processing, real time processing, complex scientific, engineering and economic calculating, simulating complex systems, multimedia, telecommunications, speech recognition, instrumentation and so on. A lot of these and other fast-changing technologies have at their core Digital Signal Processing (DSP).

The proposed computer technology essentially extends a range of a more effective performance of different applications in comparison with DSP.

This technology could provide a speed and functional reliability of computing one order higher in comparison with traditional data processing including DSP.

The applied software, accumulated for traditional computing means, can be used after minimum adapting it for solving the mentioned above problems with the help of proposed technology.

Within this project it is supposed to work out the conceptual principles, mathematic basis and main algorithms of proposed technology of data processing as well as recommendations for its realizing.

Various algorithms specially created for MAP can provide additional essential speeding up different algebraic procedures, for example, polynomial processing.

Currently some algorithms realizing this technology have been elaborated (for example for systems of linear equations, DSP, polynomial computation, whole number processing, complex number processing).

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