Mass-Parallel Sleptsov Net-Based Solving PDEs on FPGA for EmbeddedControl

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Abstract

Real-time embedded applications are normally viewed as continuous processes and are often specified using Partial DifferentialEquations (PDEs) and with certain boundary conditions. In this paper we present techniques for fast mass-parallel numerical solvingof PDEs. We compose specialized lattices based on the integer number approximation specified with Sleptsov nets to beimplemented as dedicated hardware, which we prototype on an FPGA. For mass-parallel solving of PDEs, we employ ad hoc finite-difference schemes and iteration methods that allow us to recalculate the lattice values in a single time cycle with appropriateaccuracy suitable for control of hypersonic objects and thermonuclear reactions.

Basic references

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Bio



Alexander Kostikov(Technical University “Metinvest Polytechnic” LLC, Ukraine) has got strong experience in solving application tasks of thermodynamics, nanophotonic and fluid dynamics specified by partial differential equation, computing numerical solutions as well. One of the important results obtained by Alexander Kostikov was the solution of the problem of electromagnetic wave scattering by two dielectric cylinders, which allowed to find the whispering gallery mode formation on cylynder. An important result is to solve the problem of electromagnetic wave scattering by a system of a microsphere and a nanoparticle to determine the nanoparticle size and position. These results are of great importance in the field of laser technology.

He will compose Sleptsov Net(SN) programs for fast solving practically significant task to obtain benchmarks for comparing Sleptsov Net Computing performance and acknowledge advantages of the approach. He showed the advantages of the SN approach on the example of the implementation of Thomas' algorithm for solving systems of linear algebraic equations with tridiagonal coefficient matrix.