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MATHEMATICIAN BOOSTS ASYNCHRONOUS PARALLELISED DOMAIN DECOMPOSITION

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Physicists, engineers, biologists, and other specialists often use parallel computing to solve practical problems. Each of the processors plays a small part in the simultaneous solving of one problem involving several processors, joined together in a network. Work distribution and communication between the processors depends on the specifics of the particular problem. One possible method is domain decomposition. There are separate study domains for each number of processors in an organization. For those with very high numbers, particularly in heterogeneous high-performance computing environments (HPC), asynchronous processes are essential. When subdomains overlap, Schwarz methods are used. This gives accurate results, but not when overlap is complex. In collaboration with colleagues from France and Hungary, a RUDN University mathematician developed an algorithm for parallel computing that makes asynchronous decomposition easier in many structural cases. An algorithm based on Gauss-Seidel was devised by the mathematicians. A key innovation is that the algorithm runs simultaneously on the entire domain, and alternately on subdomains and boundaries between them. The values obtained can be immediately used for boundary calculations without costing any additional resources. Researchers evaluated the algorithm on the Poisson equation and linear elasticity problems. Both equations performed faster using the new method than using the original one. An improvement of 50% was achieved - with 720 subdomains, the Poisson equation was computed in just 84 seconds rather than the original algorithm's 170 seconds. In addition, as the number of subdomains increases, the number of synchronous alternating iterations decreases. Consequently, this work opens up exciting new research possibilities and promising new applications of the asynchronous computing paradigm.