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A Time Decomposition Method to Space-Time Finite Elements for the Dirac Equation HYUN LIM, Brigham Young Univ - Provo, ARTHUR KURLEJ, MIT Lincoln Laboratory, OLIVIA COMEAU, University of Massachusetts, Amherst, NICHOLAS STEGMEIER, JUNG-HAN KIMN, South Dakota State University — Dirac equation is a relativistic wave equation that describes spin-1/2 massive particles such as electrons and quarks. Furthermore, this system can be extended with different physical aspects such as electromagnetic interaction. However, most of these system cannot be solved analytically. Therefore, numerical simulations are required to understand the nature of these systems. In this work, we examine the behavior of the gauge free, low-mass regime Dirac equation using space-time finite elements with time decomposition method. The purpose of this research is to present a new computational way for stable parallelizable algorithm of the physical system. We discretize space and time together for the entire domain using a finite element space which does not separate time and space basis functions. We also explore the effectiveness of the time decomposition preconditioner, time-additive Schwarz preconditioner with KSP (Krylov Subspace Methods) solvers for this problem.

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