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How Silent Errors Propagate in Iterative Methods

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As simulation size and machine complexity grows on next generation HPC systems, machine errors are expected to increase. In particular, silent data corruption (SDC), which occurs due to cosmic radiation striking hardware components causing the state of a transistor to flip, remains a concern key concern. SDC in iterative methods can lead to extra iterations required to find a solution, can convergence to an incorrect solution, or cause an application crash. Understanding how SDC propagates through iterative methods can lead to better mitigation systems that in turn increases effective system utilization.

In this talk, we highlight SDC in several iterative computations over a range of applications. For example we consider miniapps, including CoMD, as well as benchmarks from NAS and the graph500 suites. From this we show how SDC propagates through different operations, suggesting different algorithm-based mitigation strategies to help reduce the impact of SDC.