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**Resilience Analysis for Multigrid Methods**

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With the the advent of exascale computing expected within the next few years, the number of components in a system will continue to grow. The error rate per individual component is unlikely to improve, however, meaning that future high performance computing will be faced with faults occurring at significantly higher rates than present day installations. Therefore, the resilience properties of numerical methods will become important factors in both the choice of algorithm and in its analysis.

In this talk we present a framework for the analysis of linear iterative methods in a fault-prone environment. The effects of random node failures are taken into account through a probabilistic model involving random diagonal matrices. Using this model, we analyze the behavior of two- and multigrid methods under random node failures. Our results show that while standard multigrid is not resilient, protecting the prolongation leads to a fault-resilient variant. Both analytic convergence estimates for these methods and simulation results will be discussed.

This is joint work with Mark Ainsworth.