





Ultrascaleable Implicit Finite Element Analyses in Solid Mechanics with over a Half a Billion Degrees of Freedom

Authors:  [Mark F. Adams](#),  [Harun H. Bayraktar](#),  [Tony M. Keaveny](#),  [Panayiotis Papadopoulos](#) | [Authors Info & Claims](#)

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Abstract

The solution of elliptic diffusion operators is the computational bottleneck in many simulations in a wide range of engineering and scientific disciplines. We present a truly scalable-ultrascaleable-algebraic multigrid (AMG) linear solver for the diffusion operator in unstructured elasticity problems. Scalability is demonstrated with speedup studies of a non-linear micro-finite element analyses of a human vertebral body with over a half of a billion degrees of freedom on up to 4088 processors on the ACSI White machine. This work is significant because in the domain of unstructured implicit finite element analysis in solid mechanics with complex geometry, this is the first demonstration of a highly parallel and efficient application of a mathematically optimal

REFERENCES

- [1] {1} M.F. ADAMS, *A distributed memory unstructured Gauss-Seidel algorithm for multigrid smoothers*, in ACM/IEEE Proceedings of SC2001: High Performance Networking and Computing, Denver, Colorado, November 2001.

 [Digital Library](#) |  [Google Scholar](#)

- [2] {2} M.F. ADAMS, *Evaluation of three unstructured multigrid methods on 3D finite element problems in solid mechanics*, International Journal for Numerical Methods in Engineering, 55 (2002), pp. 519-534.

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Yoda R, Bolten M, Nakajima K and Fujii A. (2022). Assignment of idle processors to spatial redistributed domains on coarse levels in multigrid reduction in time. International Conference on High Performance Computing in Asia-Pacific Region. 10.1145/3492805.3492810. (41-51). Online publication date: 7-Jan-2022.

<https://dl.acm.org/doi/10.1145/3492805.3492810>

Jolivet P, Tournier P and West J. (2016). Block iterative methods and recycling for improved scalability of linear solvers. Proceedings of the International Conference for High Performance Computing, Networking, Storage and Analysis. 10.5555/3014904.3014927. (1-14). Online publication date: 13-Nov-2016.



12). Online publication date: 8-Jun-2016.

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