
David Appelhans
**Nested Iteration Range Decomposition: A scalable, low
communication PDE solution method with numerical
results on advection-diffusion problem.**

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Combining nested iteration, adaptive mesh refinement, and range decomposition creates a powerful PDE solution method with reduced communication costs compared to traditional solution methods. Range decomposition partitions a PDE according to the right side of the equation, rather than the domain. If the right side is approximately equally distributed, for example from a coarse adaptive least squares solve, then range decomposition equally distributes the error and is a naturally load balanced algorithm. This algorithm is naturally suited for large distributed memory systems where intra-node communication is expensive but on node computational power is plentiful. The method will be explained, a performance model will show the scaling benefits, and numerical results for an advection-diffusion type PDE will be shown.