On Hamiltonian circuited solvers for elliptic partial differential equations

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From our experiences with neutron transport problems and semiconductor device simulations, the matrices accrued from the two fundamental tenets of discrete modelling of partial differential equations of the elliptic type are usually large and sparse. Focussing on finite difference modelling, uniform mesh may not be imposed and approximations are made at each interior node by a finite difference formula. Hence, we are able to obtain linear relations of the nodes. In our Hamiltonian circuited solver for elliptic partial differential equations, we have to have an even interior grid points on both axes. We carry out our experiments using the golden ratio technique of linear search in optimization.

On using tensor products for the tridiagonal matrices, we are able to obtain computational molecules. Some of the computational molecules present interesting structures for the coefficient matrices. The structures enable us to do faster computations such as natural use of smaller matrix sizes or complete parallel computing. For computational purposes, we apply our solver to simulate the Poisson equation which constitutes one of the equations in the nonlinear set in semiconductor device simulations.