

**Meeting:** 1003, Atlanta, Georgia, AMS CP 1, AMS Contributed Paper Session

1003-65-1357      **Hanna Joy VanderZee\*** (hannajoy@gmail.com), 1205 Grant Pl, Urbana, IL 61801. *Explicit Null Space of the Discrete Laplacian*. Preliminary report.

For a given partial differential equation, such as Poisson's equation in two dimensions, stipulating the null-space component of the solution is sometimes a useful alternative to specifying boundary values in order to determine a unique solution. For this purpose, we seek a sparse representation of the null space of the Laplacian operator on the unit square, uniformly discretized using finite differences on an  $n$  by  $n$  grid. We present an explicit formula for generating a sparse null basis for arbitrary  $n$ . The formula makes use of a triangular array associated with the little Schroeder numbers. We also consider the conditioning of such a basis and demonstrate the use of the basis in a numerical procedure for computing an approximate solution to the partial differential equation. (Received October 05, 2004)