1015-65-228 **Liliana Borcea** (borcea@caam.rice.edu), MS 134, Rice University, 6100 Main Street, Houston, TX 77005-1892, **Vladimir Druskin*** (druskin1@slb.com), 320 Bent st., Cambridge, MA 02141-2025, **Fernando Guevara Vasquez** (fguevara@caam.rice.edu), MS 134, Rice University, 6100 Main Street, Houston, TX 77005-1892, and **Leonid Knizhnerman** (mmd@cge.ru), Narodnogo Opolcheniya St., House 38, Bldg. 3, 123298 Moscow, Russia. *On continuum limits of discrete inverse problems.*

We consider Finite-Difference (FD) approximations of solutions of Sturm–Liouville equations. We discretize the equations on so-called optimal grids constracted as follows. For a staggered grid with 2k points, we ask that the FD operator and the Sturm–Liouville differential operator share the k lowest eigenvalues and the values of the orthonormal eigenfunctions, at one end of the interval. This requirement determines uniquely the entries in the FD matrix, which are grid cell averages of the coefficients in the continuum problem. If these coefficients are known, we can find the grid. The point is that in the inverse problem neither the coefficients nor the grid are known. So, a key question is how to choose the grid. We prove, the optimal grid dependence on the unknown coefficients is weak, more precisely, the optimal grid becomes asymptotically independent of the coefficients (under some regularity conditions) as the number k of data points tends to infinity. As a result, an optimal grid computed for a known coefficient (for example, for a constant) gives coefficients that converge pointwise to the true (unknown) solution. Finally, we derive a finite-difference homogenization algorithm from the solution of the inverse problem. (Received February 06, 2006)