

Linear systems involving multilevel Toeplitz matrices arise in a number of applications, e.g., the discretization of certain 2D and 3D partial differential or fractional differential equations, and image deblurring problems. Krylov subspace methods are effective solvers for such problems, and for symmetric multilevel Toeplitz matrices theoretical results and efficient methods enable fast solvers with guaranteed convergence rates. Here we describe how to obtain similar results for nonsymmetric multilevel Toeplitz problems by employing a simple symmetrization. We discuss theoretical properties of these symmetrized matrices and propose effective preconditioners.