Two-dimensional semi-analytic solutions to the linearized state-based peridynamic equilibrium equation.

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Most of the analysis performed to date using the peridynamic theory of solid mechanics has been numerical in nature, utilizing spatial discretization schemes that approximate the integration of the non-local constitutive functional. The non-linear functional form of the integrand in the state-based peridynamic momentum equation causes great difficulty in obtaining analytic solutions. However, analytic or semi-analytic solutions add valuable insight into the nature of non-local deformations and are desired as validation solutions for other numerical approximations. A class of solutions have been obtained for the linearized state-based isotropic elastic peridynamic momentum equations in two-dimensions. These solutions are semi-analytic in that there is no approximation of the spatial integration of the non-local horizon; all of the analysis is performed in closed-form in Fourier space before the inverse Fourier transforms are calculated numerically to recover the Cartesian displacements. A discussion of the effects of changing the scale of the compact-support (i.e. horizon) and comparison to solutions from the local Cauchy theory of elasticity are included. It is assumed that only the tractability of the analysis would preclude the method presented herein from being extended to three-dimensions.