The Lippmann Schwinger Lanczos algorithm for inverse scattering problems

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Abstract: We combine data-driven reduced order models with the Lippmann-Schwinger integral equation to produce a direct nonlinear inversion method. The ROM is viewed as a Galerkin projection and is sparse due to Lanczos orthogonalization. Embedding into the continuous problem, a data-driven internal solution is produced. This internal solution is then used in the Lippmann-Schwinger equation, in a direct or iterative framework. The new approach also allows us to process non-square matrix-valued data-transfer functions, i.e., to remove the main limitation of the earlier versions of the ROM based inversion algorithms. We show numerical experiments for spectral domain data for which our inversion is far superior to the Born inversion. We also describe how this approach simplifies in the time domain and give examples of its use given mono static data.

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