Reduced basis methods for linear fractional elliptic problems

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Fractional differential equations have gained popularity in recent years due to their ability to model nonlocal and hysteretic phenomena. Standard formulations of such problems do not immediately lend themselves to snapshot-based model reduction via reduced basis methods (RBM). We discuss alternative formulations of fractional elliptic problems that do yield immediate RBM-type methods. In particular we develop both mathematical analysis, showing exponential decay of Kolmogorov N-widths when the fractional order of differentiation is one of the parameters, and numerical methods, which achieve model reduction with efficiency comparable to that attained for standard elliptic problems with affine dependence on parameters.