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**The infinite bi-Lanczos method for nonlinear eigenvalue  
problems**

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We propose a two-sided Lanczos method for the nonlinear eigenvalue problem. This two-sided approach provides approximations to both the right and left eigenvectors of the eigenvalues of interest. The method implicitly works with matrices and vectors with infinite size, but because particular (starting) vectors are used, all computations can be carried out efficiently with finite matrices and vectors. We specifically introduce a new way to represent infinite vectors that span the subspace corresponding to the conjugate transpose operation for approximating the left eigenvectors. Furthermore, we show that also in this infinite dimensional interpretation the short recurrences inherent to the Lanczos procedure offer an efficient algorithm regarding both the computational cost and the storage.