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A complete basis for a perturbation expansion of the general N-body problem[1] W. BLAKE LAING, Kansas State University, DAVID W. KELLE, Florida State University, MARTIN DUNN, DEBORAH K. WATSON, University of Oklahoma — We introduce a basis set to calculate perturbation coefficients in an expansion of the general N-body problem. This basis has two advantages. First, the basis is complete order-by-order for the perturbation series. Second, the number of independent basis tensors spanning the space for a given order does not scale with N, the number of particles, despite the generality of the problem. At first order, the number of basis tensors is 23 for all N although the problem at first order scales as N^6. The perturbation series is expanded in inverse powers of the spatial dimension. This results in a maximally symmetric configuration at lowest order which has a point group isomorphic with the symmetric group, S_N. The resulting perturbation series is order-by-order invariant under the $N!$ operations of the S_N point group which is responsible for the slower than exponential growth of the basis. We perform the first test of this formalism including the completeness of the basis through first order by comparing to an exactly solvable fully-interacting problem of N particles with a two-body harmonic interaction potential.

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