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Finite element method for 1D interacting few-particle systems

The fundamental equations of quantum mechanics are well-established, but their numerical solution can still be challenging, even for seemingly simple quantum systems. Despite the ever increasing computational power available, efficient numerical approaches and implementations are key. Here we investigate the quantum dynamics of two interacting bosons, trapped in an asymmetric double-well potential, by exact numerical diagonalisation of their many-body Hamiltonian. Since the underlying Hilbert space is infinite-dimensional, we seek for an approximate solution in a subspace spanned by so-called finite elements -- a mathematically well-founded, efficient, and transparent numerical approach. Our results show a clear computational advantage compared to commonly used alternative approaches, and, thus, pave the way towards new insights into the dynamics of interacting few-particle systems.