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## Sloppy nuclear energy density functionals: model reduction by manifold boundaries

Concepts from information geometry are used to analyse parameter sensitivity for a nuclear energy density functional, representative of a class of semi-empirical functionals that start from a microscopically motivated ansatz for the density dependence of the energy of a system of protons and neutrons. It is shown that such functionals are "sloppy", namely characterised by an exponential range of sensitivity to parameter variations. Responsive to only a few stiff parameter combinations, sloppy functionals exhibit an exponential decrease of sensitivity to variations of the remaining soft parameters. By interpreting the space of model predictions as a manifold embedded in the data space, with the parameters of the functional as coordinates on the manifold, it is also shown that the exponential distribution of model manifold widths corresponds to the range of parameter sensitivity. Using the Manifold Boundary Approximation Method, we illustrate how to systematically construct effective nuclear density functionals of successively lower dimension in parameter space until sloppiness is eventually eliminated and the resulting functional contains only stiff combinations of parameters.

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