

Lumping, transformation of variables, and invariant manifolds

Marc R. Roussel
University of Lethbridge, Canada

The functional iteration method for solving the invariance equation often suffers from numerical stability problems. Stabilized iteration methods gain stability in exchange for slower convergence. In the most straightforward formulation of the problem, the manifold is parameterized by phase-space variables of the original model formulation. However, it is possible to change variables, as was shown by Goussis and Valorani (2006). Their change-of-variables formulation of the invariance equation can be used to generate, among other things, reduced models expressed in terms of “lumped” or “aggregated” variables, i.e. new variables that are linear combinations of the original variables. For a suitable choice of lumped variables, the direct iterative solution of the invariance equation sometimes converges rapidly even when the corresponding computation performed with the original phase-space variables was unstable.