# Phase-space iterative solvers

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**Abstract**

We introduce an iterative method to solve problems in small-strain non-linear elasticity. The method is inspired by recent work in data-driven computational mechanics, which reformulated the classic boundary value problem of continuum mechanics using the concept of "phase space". The latter is an abstract metric space, whose coordinates are indexed by strains and stress components, where each possible state of the discretized body corresponds to a point. Two subsets are then defined: an affine space termed "physically-admissible set" made up by those points that satisfy equilibrium and a "materially-admissible set" containing points that satisfy the constitutive law. Solving the boundary-value problem amounts to finding the intersection between these two subdomains. Our iterative method consists on projecting points alternatively from one set to the other, until convergence. The method is similar in spirit to the "method of alternative projections" and to the "method of projections onto convex sets", for which there is a solid mathematical foundation that furnishes conditions for existence of solutions and convergence. Its aptitude to deal with constitutive laws based on neural network is also discussed.

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