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BIFURCATION ONTO AN AFFINE SUBSPACE FOR SEPARABLE PARAMETERIZED EQUATIONS

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Many applications give rise to separable parameterized equations of the form $A(y,\mu)z + b(y,\mu) = 0$, where $y \in \mathbb{R}^n$, $z \in \mathbb{R}^N$, and $\mu \in \mathbb{R}$; here $A(y,\mu)$ is an $(N+n)\times N$ matrix and $b(y,\mu) \in \mathbb{R}^{N+n}$. Bifurcation onto an affine subspace occurs when $A(y,\mu)$ is rank deficient at a solution of this equation. By extending a variant of the Golub-Pereyra variable projection method we derive a numerical method for computing such a point. Our method locates the bifurcation phenomenon in a smaller space than the original problem. The dimension of the problem can thus be dramatically reduced when N is much larger than n, as occurs in discretizations of differential equations. Numerical examples illustrating our method are provided.

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