Detecting multiplicity for systems of second order equations: an alternative approach

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We are concerned with a system of second order differential equations of the form $x'' + A(t,x)x = 0$, $t \in [0, \pi]$, $x \in I\!\!R^N$, where $A(t,x)$ is a symmetric $N \times N$ matrix. We concentrate on an asymptotically linear situation and we prove the existence of multiple solutions to the Dirichlet problem associated to the system. Multiplicity is obtained by a comparison between the number of moments of verticality of the matrices $A_0(t)$ and $A_\infty(t)$, which are the uniform limits of $A(t,x)$ for $|x| \to 0$ and $|x| \to +\infty$, respectively. For the proof, which is based on a generalized shooting approach, we provide a theorem on the existence of zeros of a class of N-dimensional vector fields.