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On the criterion of asymptotical stability for index-1 tractable DAE.

The index-1 tractable differential-algebraic equation $Ax'(t) + Bx(t) = 0$ is considered. The Lyapunov stability of the trivial solution is discussed. The asymptotical stability of the trivial solution can be fully characterized by the quantitative parameter $æ(A, B) = 2\|A\|\|B\|\|H\|$, where

$$H = \frac{1}{2\pi}\int_{-\infty}^{\infty}(A+BQ)^*(i\xi A+B)^{-*}P^*FP(i\xi A+B)^{-1}(A+BQ)d\xi+Q^*FQ.$$

Here the matrices P and Q are the projectors onto the invariante subspaces of the matrix pencil $\{A, B\}$ associated with the finite and infinite eigenvalues, respectively, and $F = (A + BQ)^{-*}(A + BQ)^{-1}$. The parameter $æ(A, B) < \infty$ if and only if the index of the pencil $\{A, B\}$ is not greater than 1 and all its finite eigenvalues have negative real parts. A methods of reducing the pencil $\{A, B\}$ with index 1 to the Kronecker canonical form and of computing the projectors P, Q and the parameter $æ(A, B)$ are described.