JÓZEF DUDA

The Lyapunov functionals for time delay systems

Summary

In this monograph are presented results of the author's research on the determination of the Lyapunov functionals for linear systems with time delay and its applications in the parametric optimization problem. The Lyapunov quadratic functionals are used to calculation of a value of a quadratic performance index of quality in the process of parametric optimization for time delay systems. The value of that functional at the initial state of the time delay system is equal to the value of a quadratic performance index of quality. To calculate the value of a performance index of quality one needs the formulas for the Lyapunov functional coefficients. In this monograph the method proposed by Repin [79] is applied to obtain the Lyapunov functionals, with coefficients given by analytical formulas. In Chapter 2. are considered systems with the retarded type time delay. This method is applied to the system with one delay (Chapter 2.2), to the system with two delays (Chapter 2.3), to the retarded type time delay system with both lumped and distributed delay (Chapter 2.4), to the system with a retarded type time-varying delay (Chapter 2.5). In Chapter 3. are considered neutral systems. Repin's method is applied to the neutral system with lumped delay (Chapter 3.2), to the neutral system with both lumped and distributed delay (Chapter 3.3) and to the neutral system with a time-varying delay (Chapter 3.4). In last years a method of determination of a Lyapunov functional by means of Lyapunov matrices is very popular, see for example [50–66, 72, 73, 76, 81–83]. This method is applied to the parametric optimization problem of retarded type time delay system both with one and two delays (Chapter 4) and to the parametric optimization problem of neutral type time delay system for system with one and two delays (Chapter 5). The examples of using of the Lyapunov functionals to calculation of the performance index value in the parametric optimization problem for linear systems with time delay are given.