On Lyapunov type inequalities for linear Hamiltonian systems on time scales

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Since many real world phenomenon occur in continuous time or discrete time or in a mix of both, it is more adequate to model them by dynamic systems which harmonize and unite the two approaches of dynamic modelling: differential and difference equations. The need of these hybrid models lead to the invention of theory of time scale calculus which is applicable to any field in which dynamic processes can be described with continuous or discrete models such as economics, quantum theory (q-calculus), population dynamics, electric circuit, bio-mathematics and robotics. Moreover Lyapunov type inequalities have become a popular research area in recent years due to the fact that they provide not only better understanding of the qualitative nature of the solutions of dynamic systems on arbitrary time scales, for instance oscillation, disconjugacy, stability and asymptotic behavior of solutions, but also deeper analysis for boundary and eigenvalue problems.
In this talk, we give a survey on Lyapunov type inequalities for linear dynamic Hamiltonian systems on time scales. Since linear second order differential/dynamic equations and linear differential/difference/dynamic systems are special cases of general linear dynamic Hamiltonian systems, we present the results obtained for such equations and systems as well. Then we show a new Lyapunov type inequality for $2n \times 2n$ dimensional linear dynamic Hamiltonian systems which covers continuous case and which is new for discrete case. As an application of Lyapunov type inequality, we derive disconjugacy criterion for such systems which gives a sufficient condition for the uniqueness of solutions of the corresponding nonhomogeneous boundary problem and we find a lower bound for the eigenvalues of the associated eigenvalue problems.

Keywords. Lyapunov inequality, time scale calculus, dynamic equations, linear dynamic Hamiltonian systems

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