"A damper optimization for linear vibrating systems using Lyapunov equation"

Friday October 19, 2:30 pm
Pickard Hall, Room 304

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Abstract:

We consider a second order damped-vibration equation

$$M\ddot{x} + D(v)\dot{x} + Kx = 0,$$

where $M, D(v), K$ are real, symmetric matrices of order n. The damping matrix $D(v)$ is defined by $D(v) = C_u + C(v)$, where C_u presents internal damping and $\mathrm{rank}(C(v)) = r$, where v is dampers' viscosity. A very important question arises in considerations of such systems: *for the given mass and stiffness determine the available dampers' viscosities so as to insure an optimal evanescence*. It can be shown that one possible optimization criteria is given by requirement of the minimization of the trace of the Lyapunov equation, that is $Tr(X(v)) = \min$, as a function $v \to Tr(X(v))$, where $X(v)$ is the solution of the following Lyapunov equation

$$A(v)X(v) + X(v)A^T(v) = -GG^T,$$

where $A = A(v)$ is a $2n \times 2n$ matrix obtained from $M, D(v), K$. Also some new estimates for the eigenvalue decay rate of the solution of the Lyapunov equation $AX + XA^T = -GG^T$, with a low rank right-hand side G will be presented. The new bounds show that the right-hand side G can greatly influence the eigenvalue decay rate of the solution.

The Math Department will provide refreshments 30 min. prior to the presentation.