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Mean square asymptotic stability characterisation of perturbed linear stochastic functional differential equations

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In this talk we present necessary and sufficient conditions that ensure various types of stability of the mean square of the following perturbed linear stochastic functional differential equation,

$$dX(t) = \left(f(t) + \int_{[-\tau,0]} X(t+s)\nu(ds) \right) dt + \left(g(t) + \int_{[-\tau,0]} X(t+s)\mu(ds) \right) dB(t),$$

where ν and μ are finite Borel measures. In particular we are concerned with when the mean square of solutions tend to zero, when this convergence to zero is exponentially fast and when the mean square lies in $L^1(\mathbb{R}_+)$. We find convergence to zero of the mean square of the unperturbed equation to be essential for sharp results, along with certain "interval average" conditions on the functions f and g. All conditions can be formulated in terms of the problem data. Additionally we highlight how the conditions on the forcing functions used in our results can also be used to characterise the solution space of deterministic perturbed Volterra integrodifferential equations.

This is joint work with John Appleby (Dublin City University).