Distributed delay differential equations – numerical approach

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We will present a new solution strategy for distributed delay differential equations, i.e.

$$\dot{x}(t) = f\left(t, \int_0^\infty x(t-s)g(s)\mathrm{d}s\right), \tag{1}$$

where g is a density of some nonnegative random variable. There is a well-known [1] way to transform equation (1) to a system of ordinary differential equations in the case that g is a density of gamma distribution.

We will show that a density of a nonnegative random variable can be approximated by a sum of densities of gamma distributions. This result can be extended to solve equation (1) numerically.

2010 Mathematics Subject Classification: 34K07.

References

[1] SMITH, Hal. *An introduction to delay differential equations with applications to the life sciences.* Springer Science & Business Media, 2010