Maximum principles for functional differential equations with ordinary or partial derivatives and nonlocal boundary conditions

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The objective of this talk is to present an approach to study maximum principles for functional differential equations with ordinary or partial derivatives. On this basis, assertions about existence, uniqueness, and sign properties of solutions to nonlocal boundary value problems, problems with non-separating boundary conditions, and nonlinear boundary conditions could be obtained. The idea of our approach is to construct a corresponding linear "model" problem of the order m possessing properties, which we want to find in the given problem of the order n. Substituting a solution's representation of the "model" problem in the given one, we reduce obtaining maximum principles to analysis of positivity of solutions to a corresponding operator equation (when $n = m$) or to boundary value problems, which are more "convenient" for us (in the cases $m < n$ or $m > n$). For this analysis corresponding "nonoscillation" methods could be used. The idea of a substitution can be also used for hyperbolic partial differential equations. Although the given equation is partial differential, both equations (a "model" one and the differential equation after substitution) could be with ordinary derivatives only. Thus the Green operator of corresponding partial functional differential boundary value problem could be presented as a product of the Green operators of several problems with functional differential equations with ordinary derivatives. This allows us to use a technique developed for equations with ordinary derivatives for the study of boundary value problems with partial functional differential equations.