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Model reduction for integro-differential equations

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Model reduction approaches for general linear Volterra integro-differential systems are studied. A structure-preserving method based on generalized system Gramians is introduced. It is shown that these Gramians can be characterized as solutions of certain delay Lyapunov equations similarly arising for other classes (e.g. finite delay) of systems. The usual energy interpretation of the Gramians is provided and a reduced-order model is obtained by truncation of a balanced system. The new approach allows to reduce coupled as well as time fractional systems. Numerical examples demonstrating the applicability of the method are given.