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Chapter Title: Delays and Propagation: Control Liapunov Functionals and Computational Issues

Abstract

There are considered some controlled objects with distributed parameters described by partial differential equations of hyperbolic type inducing wave propagation, connected at its turn with propagation delays. The boundary conditions are non-standard being described by ordinary differential or integro-differential equations. Basic theory—existence, uniqueness, well posedness-, stability and stabilization and numerical computations are considered for the benchmark problem of the marine vessel crane: its model is very much alike not only to other cranes but also to the flexible manipulator or the oilwell drillstring. In the lossless case basic theory is associated to the basic theory for some functional differential equations of neutral type. Stabilization is achieved by synthesizing low order controllers via c.l.f. (Control Liapunov Functional) induced by the energy identity for the partial differential equations. The numerics are considered within the framework of the method of lines implemented by applying the paradigm of the Cellular Neural Networks, an applied issue of Neuromathematics. After an illustrating simulation for the closed loop model some general conclusions and open problems are enumerated.