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Optimal robustness of passive systems

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We construct optimally robust port-Hamiltonian realizations of a given rational transfer function that represents a passive system. We show that the realization with a maximal passivity radius is a normalized port-Hamiltonian one. Its computation is linked to a particular solution of a linear matrix inequality that defines passivity of the transfer function, and we provide an algorithm to construct this optimal solution. We also consider the problem of finding the nearest passive system to a given nonpassive one and provide a simple but suboptimal solution. These problems are formulated for both continuous-time and discrete-time systems and is linked to the problem of finding a realization of a rational transfer function such that its passivity radius is maximized.

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