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Finding the nearest bounded-real port-Hamiltonian system

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We consider linear time-invariant continuous control systems that are bounded real, also known as scattering passive. Our main theoretical contribution is to show the equivalence between such systems and port-Hamiltonian (PH) systems whose factors satisfy certain linear matrix inequalities. Based on this result, we propose a formulation for the problem of finding the nearest bounded real system to a given system and design an algorithm combining alternating optimization and Nesterov's fast gradient method. This formulation also allows us to check whether a given system is bounded real by solving a semidefinite program and provide a PH parametrization for it. We illustrate our proposed algorithms on real and synthetic data sets.

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