

## Graph topology and gap topology for unstable plants

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# GRAPH TOPOLOGY AND GAP TOPOLOGY FOR UNSTABLE PLANTS

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## ABSTRACT

This paper provides a reformulation of the graph topology and the gap topology in a very general setting. Many essential properties and their comparison are clearly presented in the reformulation. It is shown that the gap topology is suitable for the general systems rather than square systems with unit feedback. It is also revealed that, whenever an unstable plant can be stabilized by a feedback, it is a closed operator mapping input space to output space. Hence the gap topology can always be applied whenever the unstable plants can be stabilized. The graph topology and the gap topology are suitable for different unstable subsets, and have many similar characteristics. If one confines them on the same subset, they will produce the same convergence. It is also shown that neither the graph topology nor the gap topology can conclude the causality in the meaning that a causal stable plant may lose its causality after a small perturbation measured by the graph topology or the gap topology. Finally, the definitions of the graph metric and the gap metric are offered. The graph metric defined here is not concerned with the spectral factorization problem and can be directly computed once the right coprime fractions are found.

Keywords: graph topology, gap topology, unstable plants, feedback system.

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