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Graph theory and nonreciprocity in coupled-mode systems LEONARDO RANZANI, JOSE AUMENTADO, National Institute of Standards and Technology, Boulder, CO — Coupled-mode systems involving more than 2 interacting modes can break reciprocal symmetry and unidirectional mode conversion can be observed. This is the case, for example, in multiple-pump parametric processes and in superconducting DC-SQUID amplifiers.[1] While reciprocity in dual-mode systems can be broken only in a sequenced coupling scheme, a sequence is not required in systems with more than 2 interacting modes. The analysis of such systems is, however, extremely complex when a high number of coupled modes is involved. In this talk we are going to discuss how graphs can be used to analyse reciprocity in coupled-mode systems and reveal the conditions that need to be satisfied for reciprocity to be broken. In this representation modes are associated to vertices and couplings to edges in an abstract graph. General conditions for reciprocity can be determined from the connectivity of the graph.

[1]A. Kamal, *et al.* "Noiseless non-reciprocity in a parametric active device" *Nature Physics*, 7.4, (2001): 311-315

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