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Positive equilibria of weakly reversible power law kinetic systems with linear independent interactions

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In this talk, we present our results on power law kinetic systems whose kinetic order vectors (which we call "interactions") are reactant-determined (i.e. reactions with the same reactant complex have identical kinetic order vectors) and are linear independent per linkage class. In particular, we focus on its subset called PL-TLK systems. Our main result states that any weakly reversible PL-TLK system has a complex balanced equilibrium. We can consider this result as a "Higher Deficiency Theorem" for such systems since in our previous work, we derived analogues of the Deficiency Zero and the Deficiency One Theorems for mass action kinetics (MAK) systems for them, thus covering the "Low Deficiency" case. On the other hand, our result can also be viewed as a "Weak Reversibility Theorem" (WRT) in the sense that the statement "any weakly reversible system with a kinetics from the given set has a positive equilibrium" holds. According to the work of Deng et al. and more recently of Boros, such a WRT holds for MAK systems. However, we show that a WRT does not hold for two proper MAK supersets: the set PL-NIK of non-inhibitory power law kinetics (i.e. all kinetic orders are non-negative) and the set PL-FSK of factor span surjective power law kinetics (i.e. different reactants imply different interactions).

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