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Ramp Function Approximations of Michaelis-Menten Functions in a Model of Plant Metabolism

Adams, Ehlting, and Edwards showed that in a model of plant phenylalanine metabolism following Michaelis-Menten kinetics, there are two mechanisms by which primary metabolism can be prioritized over secondary metabolism when input is low: the *Precursor Shutoff Valve* (PSV) and threshold separation. Analysis of the model was made difficult due to the presence of the Michaelis-Menten terms; hence, it is worth considering whether linear approximations of these terms can be used to both simplify the model and keep its qualitative behaviour intact. In this talk, we will introduce piecewise approximations of Michaelis-Menten functions called *ramp functions*. We will show that when the Michaelis-Menten terms are replaced by ramp functions in the model, the PSV is completely effective when it comes to the prioritization of primary metabolism under low input conditions, while threshold separation is effective when the PSV is absent, but only if the threshold constant of the secondary metabolic pathway is sufficiently larger than that of the primary pathway.