# Convex Reformulation of MFD Constraint

We introduce auxiliary variables and , which indicate the validity of and , respectively, when set to 1. These two if-logic constraints can be formulated as follows,



(A.1a)



(A.1b)



However, the then-logic constraints (44)-(45) are in second-order cone (SOC) form, and directly applying the big-M method would disrupt convexity. To address this, we introduce intermediate variables , and , allowing (44)-(45) to be strictly inner approximated, we take the transformation of (44) as an example, with (45) following the same approach.



After introducing the intermediate variable, (44) can be expressed as (A2),

(A.2a)



(A.2b)



Clearly, (A3) is a sufficient condition for (A2.a),

(A.3a)



(A.3b)



At this stage, the then-logic constraint is convexified using the big-M method, and combined with the if-logic constraint, yielding the inner approximation of (44).