Bare Demo of IEEEtran.cls for Conferences

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***Abstract*—The abstract goes here.**

I. Introduction

This demo file is intended to serve as a "starter file" for IEEE conference papers produced under LaTeX using IEEE-tran.cls version 1.7 and later. I wish you the best of success.

mds

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A. *Subsection Heading Here*

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II. MILP Model

Assumptions:

- Time series are numOfIntervals, and time step is 1 interval
- renewable energy pattern for each minute is given, as G(t)
- Energy/power Demand for each minute is given, as D(t), in the unit of kWh, and for now it is constant at each time step.
- There are three ESDs in the hierarchy, from top to bottom are: renewable(G), battery(B), and flywheel(F)
- At the beginning of the time series, the energy stored in battery(B) and flywheel(F) are half full, equal to their corresponding max capacities.
- The way this ESD hierarchy works is: G can charge B and F, as well as satisfy D; B can charge F, and D; F can only satisfy D.
- The self discharge of B(Loss rate of B) can be ignored, whereas that of F cannot.
- If, at each time step, G cannot be used fully, it is wasted(cannot be used for later time steps)

Variables that can be controlled, for each time step t:

- $B_g(t)$: the amount of green energy charged into B, variable 1 to numOfIntervals
- $F_g(t)$: the amount of green energy charged into F, numOfIntervals + 1 to 2 * numOfIntervals
- $D_g(t)$: the amount of green energy to satisfy D, 2 * numOfIntervals + 1 to 3 * numOfIntervals
- $F_b(t)$: the amount of battery energy to charge F, 3 * numOfIntervals + 1 to 4 * numOfIntervals
- $D_b(t)$: the amount of battery energy to satisfy D, 4 * numOfIntervals + 1 to 5 * numOfIntervals
- $DoD_b(t)$: the Depth of Discharge of B, 5 * numOfIntervals + 1 to 6 * numOfIntervals
- $D_f(t)$: the amount of flywheel energy to satisfy D, 6 * numOfIntervals + 1 to 7 * numOfIntervals
- $DoD_f(t)$: the Depth of Discharge of F, 7 * numOfIntervals + 1 to 8 * numOfIntervals
- $E_b(t)$: the amount of energy stored in B, 8 * numOfIntervals + 1 to 9 * numOfIntervals
- $E_f(t)$: the amount of energy stored in F, 9 * numOfIntervals + 1 to 10 * numOfIntervals
- $B_{bin}(t)$: mutual exclusive binary variables for battery, 10 * numOfIntervals + 1 to 11 * numOfIntervals
- $F_{bin}(t)$: mutual exclusive binary variables for flywheel, 11 * numOfIntervals + 1 to 12 * numOfIntervals
- All these variables have the unit of kWh, except 6 and 8, which are percentages, and 11, 12 are binary numbers.

Objective function: The objective for now is to:

- maximize the expected life time of the battery: $Period_OfPeak_Power * Life_Cycle * (DoD_max_b/DoD_b)$, in the unit of year. The period of peak power is assumed to be 1 minute, the life cycle of the battery is 2 (2000 numbers of discharge), DoD_max is 0.8
- minimize the discharge of battery
- maximize the battery storage at each time step.
- These three objective functions can be represetned using different weights.

Constraints:

- $D_b(t) + F_b(t) <= r_b * (Max_Capa_B/battery_rate)$, discharge rate : charge rate of the battery
- $B_g(t) <= Max_Capa_B/battery_rate$,, charge rate of B is bounded, fully charge in 20 hours or 1200 minutes
- $E_b(t) <= Max_Capa_B$
- $E_f(t) <= Max_Capa_F$
- $(1 - DoD_b(t)) * Max_Capa_B <= E_b(t)$
- $(1 - DoD_f(t)) * Max_capa_F <= E_f(t)$
- $Given(F_b(t) + D_b(t) > 0), B_g(t) = 0$: battery cannot be charged and discharged at the same time
- $GivenD_f(t) > 0, F_b(t) + F_g(t) = 0$: flywheel cannot be charged and discharged at the same time
- $F_g(t) + D_g(t) + B_g(t) <= G(t)$
- $DoD_b(t) <= DoD_max_b$
- $DoD_f(t) <= DoD_max_f$
- $D_g(t) + D_b(t) + D_f(t) = D(t)$
- $E_b(t) = E_b(t-1) + efficiency_b * B_g(t-1) - (F_b(t-1) + D_b(t-1))$, the energy stored in B for each time step
- $E_f(t) = E_f(t-1) + efficiency_f * (F_g(t-1) + F_b(t-1)) - D_f(t-1) - self_discharge_rate_f * E_f(t-1)$
- $D_b(t) + F_b(t) <= E_b(t)$, battery cannot discharge more than it current has
- $D_f(t) <= E_f(t)$, flywheel cannot discharge more than it currently holds
- All variables are greater than 0

III. Conclusion

The conclusion goes here.

Acknowledgment

The authors would like to thank...

References

[1] H. Kopka and P. W. Daly, *A Guide to LaTeX*, 3rd ed. Harlow, England: Addison-Wesley, 1999.