

Supplementary Material for “A Game-Theoretic Approach to Analyzing Equilibria in Coupled Power and Transportation Network”

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In the supplementary material, we give the detailed information of the numerical examples in the paper “A Game-Theoretic Approach to Analyzing Equilibria in Coupled Power and Transportation Network”.

I. SIOUX FALLS TRANSPORTATION NETWORK

Figure 1 shows the network of Sioux Falls in South Dakota, USA. The area of Sioux Falls is 190.20 km² (73.47 sq mi) [1].

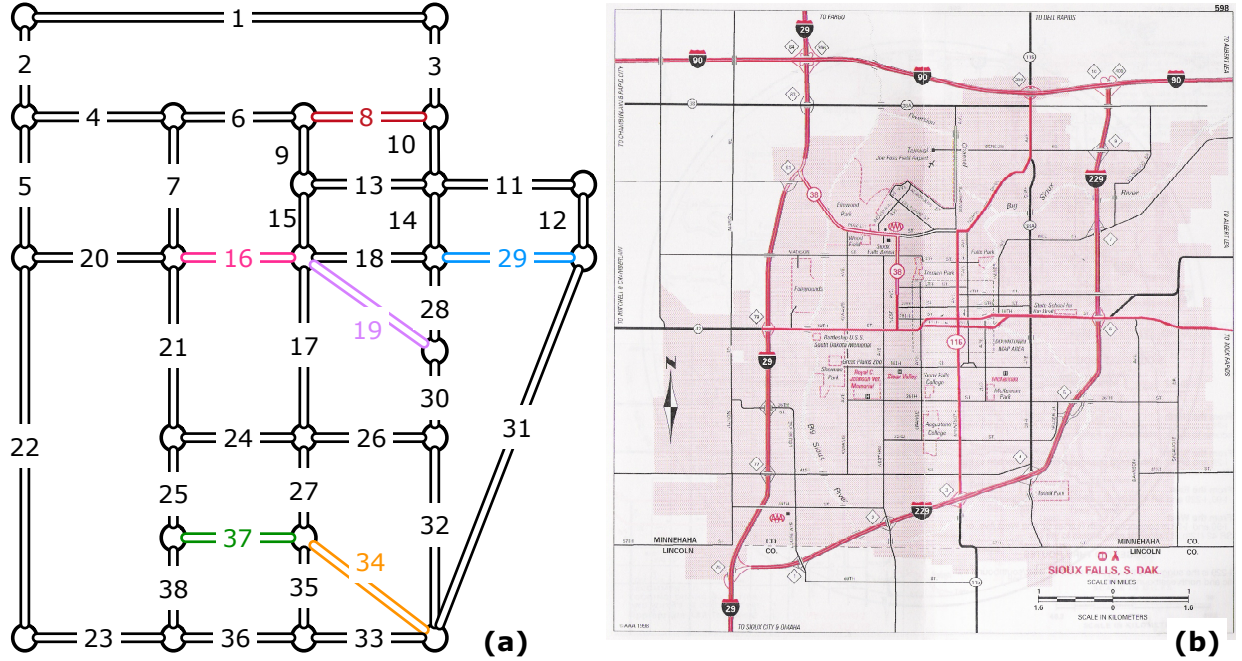


Fig. 1. (a) Sketch of Sioux Falls transportation network. (b) Map of Sioux Falls.

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Figure 2 shows the road length of the Sioux Falls transportation network [1]. Note that the length of the arcs does not necessarily have direct connection with the geographic length of the roads.

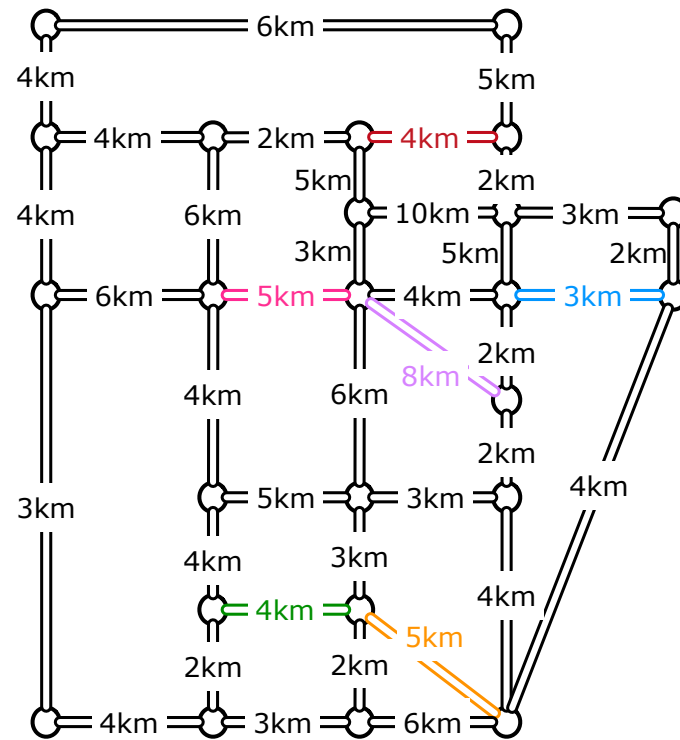


Fig. 2. Road length of Sioux Falls transportation network.

II. 33-NODE POWER NETWORK

Figure 3 shows a 33-node radial distribution network with voltage of 12.66 kV [2].

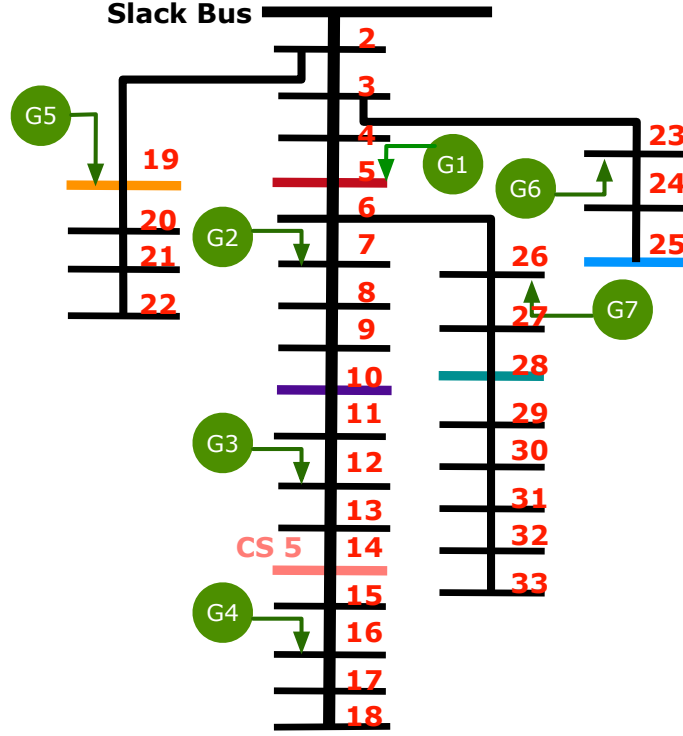


Fig. 3. 33-node power distribution network.

A. Branch Parameters

The branch parameters are listed in Table I.

B. Load Data

The peak load data are listed in Table II. The load at each node is assumed to be composed by residential load, commercial load and agricultural load.

III. COUPLING NETWORKS

Figure 4 shows the Sioux Falls transportation network coupled with a 33-node power network. The coupled nodes/arcs are labeled with identical colors.

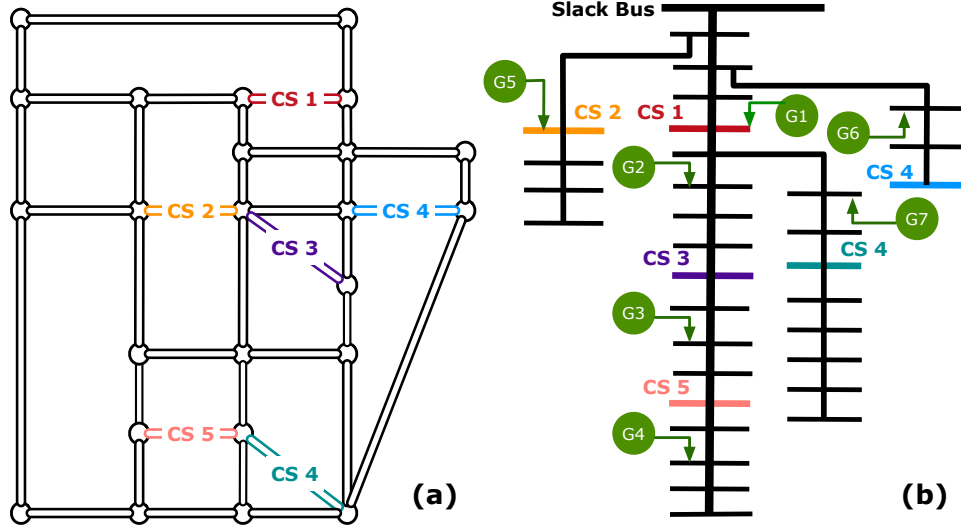


Fig. 4. (a) Sioux Falls transportation network. (b) 33-node power network. The coupled arcs/nodes are labeled in the same colors.

A. Coupling Relationship

The coupling relationship is given in the following table.

TABLE I. Coupling relationship between power and transportation networks (CS: Charging Station).

No.	Arc in Transportation Network	Node of Power Network
CS 1	8	5
CS 2	16	19
CS 3	19	10
CS 4	29	25
CS 5	34	28
CS 6	37	14

B. Travel Demand

The following table shows the travel demand between origin-destination pairs. The traffic demand is normalized [3] with a unit of traffic flow of 10^3 veh/h [4], i.e., there are 5000 EVs per hour for each OD pair.

TABLE II. Travel demand between origin-destination pairs for the coupled networks.

OD demand	Origin	Destination	Charging demand (P.U.)	Non-charging demand (P.U.)
OD 1	2	24	5	25
OD 2	2	13	5	30
OD 3	2	7	5	20
OD 4	1	9	5	30
OD 5	19	7	5	30
OD 6	14	2	5	10
OD 7	14	24	5	20
OD 8	2	14	5	20
OD 9	7	19	5	20
OD 10	13	2	5	15
OD 11	1	8	5	25
OD 12	1	7	5	30

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