APPENDIX A

THE MODELING PROCEDURE OF THE PROPOSED SFG MODELING TECHNIQUE

STEP 1:

FIND THE QUALIFIED SWITCHING STATES

Find out the possible switching states and delete the unnecessary states according to the constraints.

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STEP 2:

CREATE THE SWITCHING FUNCTIONS OF DIODES $F_{Djk}(t)$

Create the switching functions of diodes by using the logical operators to combine the switching functions $F_{Sjk}(t)$ and current directions $sign(i_j)$.

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STEP 3:

DEFINE THE VIRTUAL SWITCHES S_i

Integrate the qualified switching states to define the virtual switches.

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STEP 4:

CREATE THE VIRTUAL SWITCHING FUNCTIONS $F_i(t)$

By using the logical operators to combine the switching functions $F_{Sjk}(t)$, current directions $sign(i_j)$ and the switching functions of diodes $F_{Djk}(t)$, the virtual switching functions can be created.

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STEP 5:

PLOT THE EQUIVALENT CIRCUIT

According to the definitions of virtual switches, the switching converter can be simplified to an equivalent circuit.

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STEP 6:

FIND THE DYNAMIC EQUATIONS

Based on the equivalent circuit and the virtual switching functions, the dynamic equations can be obtained.

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STEP 7:

CREATE THE SWITCHING FLOW-GRAH

According to the dynamic equations and basic SFG modeling technique, the switching flow-graph can be created.

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STEP 8:

DEVELOP THE CORRESPONDING MODELS

The large-signal model, steady-state model and small-signal model can be developed from the switching flow-graph by replacing the switching branches with their corresponding models.