Small-Signal Analysis Steps

Complete **each** of these steps if you choose to correctly complete a diode **small-signal** analysis.

Step 1: Complete a **D.C. Analysis**

* Turn **off** all **small-signal** sources, and then complete a circuit analysis with the remaining **D.C. sources** only.

Good news! The **CVD** model is accurate enough for this step (but make sure you complete every step of the **ideal** circuit analysis).

* Estimate I_D for **each** junction diode.

Remember, capacitors are DC **opens** and inductors are DC **shorts**!

Step 2: Calculate diode **small-signal resistance** r_D

For **each** junction diode, determine r_D as:

$$r_D = \frac{n\, V_T}{I_D}$$

Step 3: Replace junction diode with a **small-signal PWL model**

The **ideal** diode in the PWL model will be in the same bias state as the **ideal** diode in the CVD model in step 1.

In other words, if you determined in step 1 that an ideal diode is forward biased, then rest assured the same ideal diode is forward biased in this step!

Step 4: Determine the **small-signal circuit**.

* Turn off all **D.C. sources**.

Remember:

A zero **voltage** source is a **short**.

A zero **current** source is an **open**.

More good news! Since source V_{DO} is a **DC** source, then we set it to zero--there is **no need** to calculate V_{DO}!

* Approximate all DC **blocking capacitors** as AC **short circuits** in your small-signal circuit (i.e., **remove** all blocking capacitors in the schematic, and **replace** them with short circuits).

* Approximate all AC **choke inductors** as AC **open circuits** in our small-signal circuit (i.e., **remove** all choke inductors in the circuit schematic, and **replace** them with short circuits).

Step 5: Analyze the **small-signal circuit**.

Analyze the circuit with small-signal sources **only**, to find all **small-signal** voltages and currents.

It will likely be helpful to **simplify** and **redraw** the resulting small-signal circuit. Since a **bunch** of the original circuit devices (e.g., DC sources, inductors, capacitors) may have been **replaced** with shorts and opens, the resulting small-signal circuit can often be **greatly simplified**.

Hint: Your small-signal currents and voltages cannot and must not have a DC component! If they do, it means that you have left "on" one or more DC sources! For example, if i_d is the small-signal **current** through the diode, then the small signal **voltage** v_d across the diode is:

$$v_d = i_d r_D$$

Thus, answers such as $v_d = i_d r_D + 0.7$ or $v_d = i_d r_D + V_{D0}$ are **not** correct!