

Special Problem 8.5-1

You have designed a **low-pass filter** with **lumped** elements, and now wish to approximate the design with **distributed** elements.

But **instead** of using Richard's Transformation, you decide to use **Stiles' Transformation!**

The Stiles transformation is **similar** to the Richard's transformation, in that it uses **shorted** and **open stubs** to approximate capacitors and inductors.

However, in the Stiles transformation, the **electrical length** of each stub **must be** $\beta_c \ell = 2\pi/3$ ($\beta_c \ell = 120^\circ$), where $\beta_c = \omega_c/v_p$, and ω_c is the cutoff frequency of the low-pass filter.

Determine the distributed element **design** for the Stiles transformation to replace:

a) an inductor L

b) a capacitor C

Specifically, determine the **type of stub** required for each design (open or short) and the **characteristic impedance** of each stub in terms of the lumped element value (L or C), and cutoff frequency ω_c .

Remember, the electrical length of each stub **must be** $\beta_c \ell = 2\pi/3$ ($\beta_c \ell = 120^\circ$)!