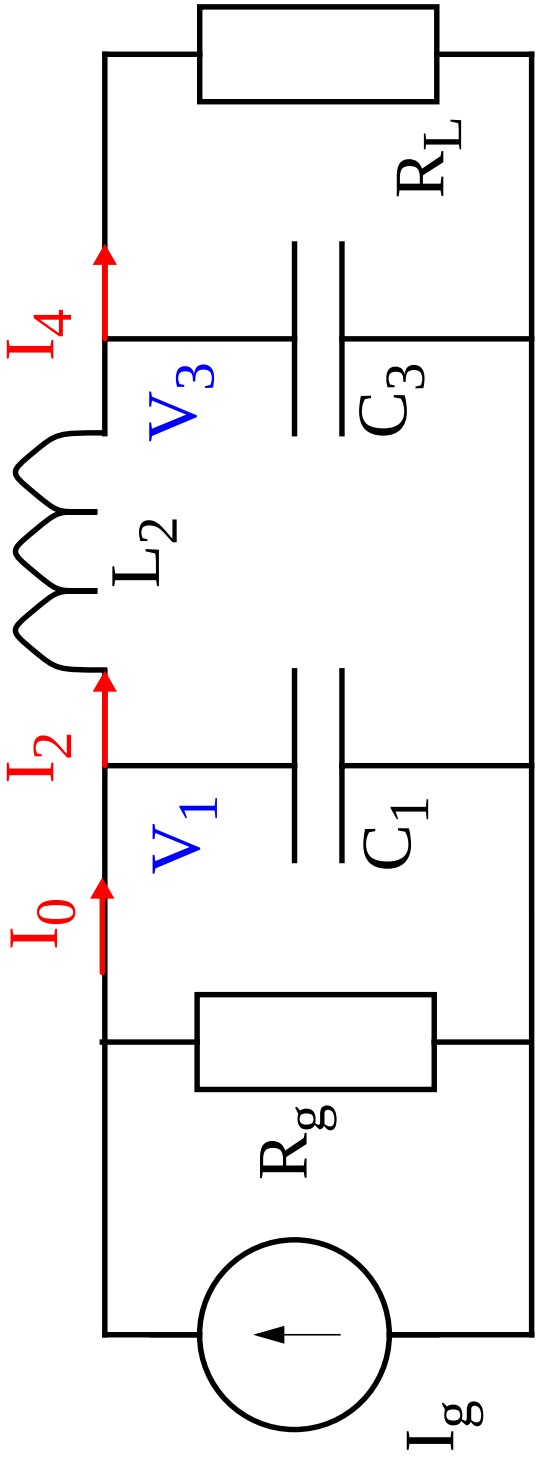
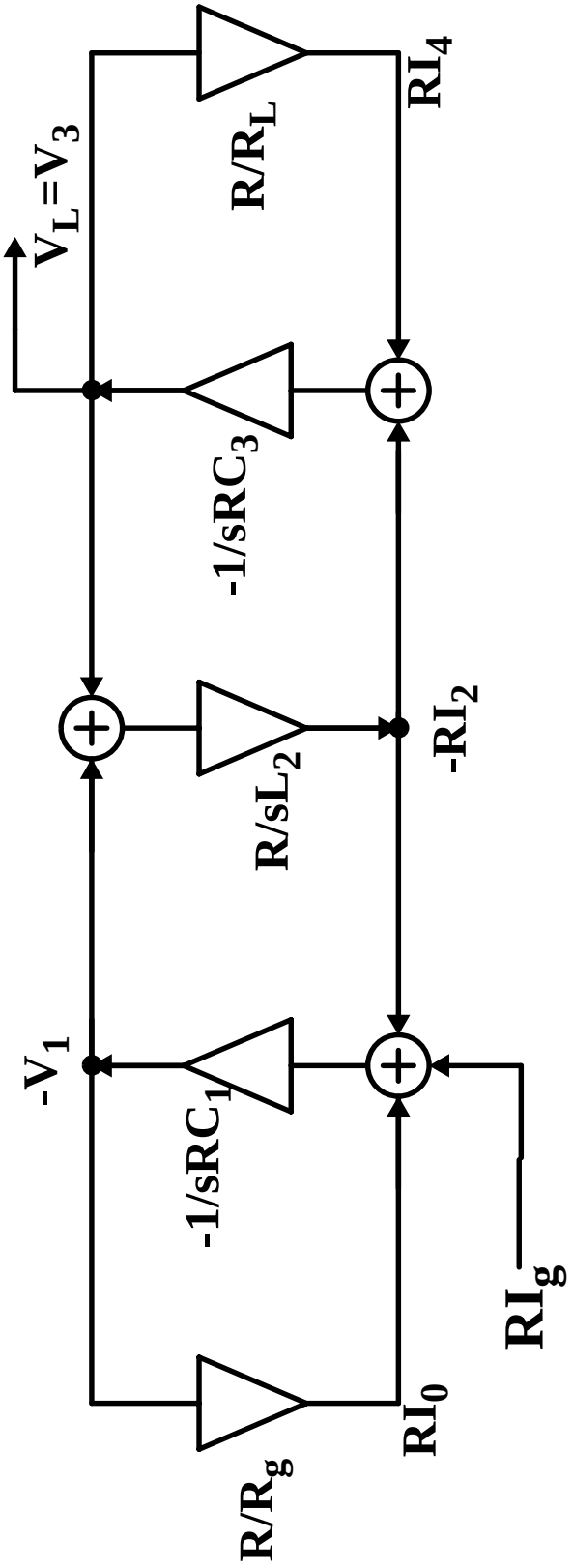
Slides for lecture 9

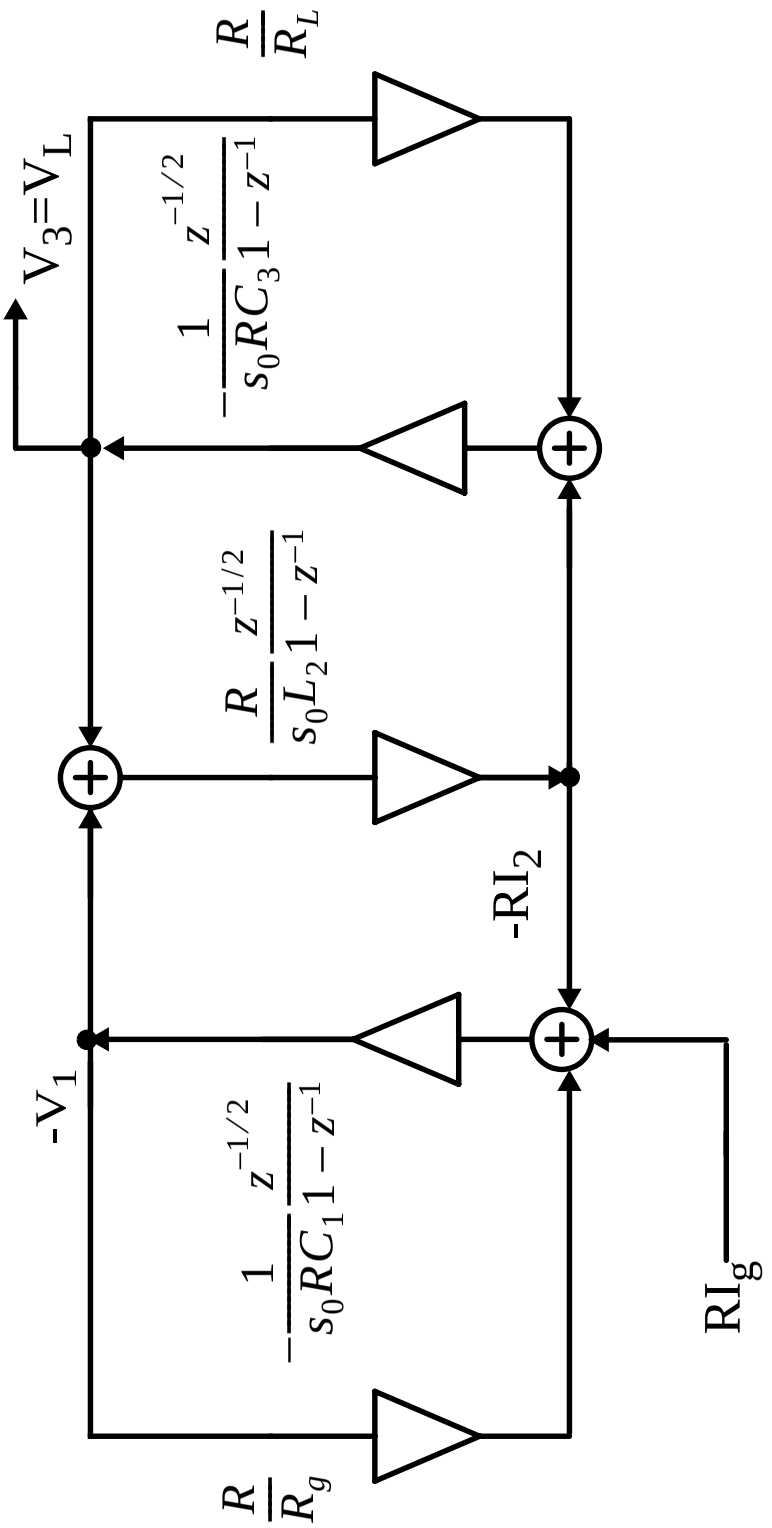
Ladder reference filter



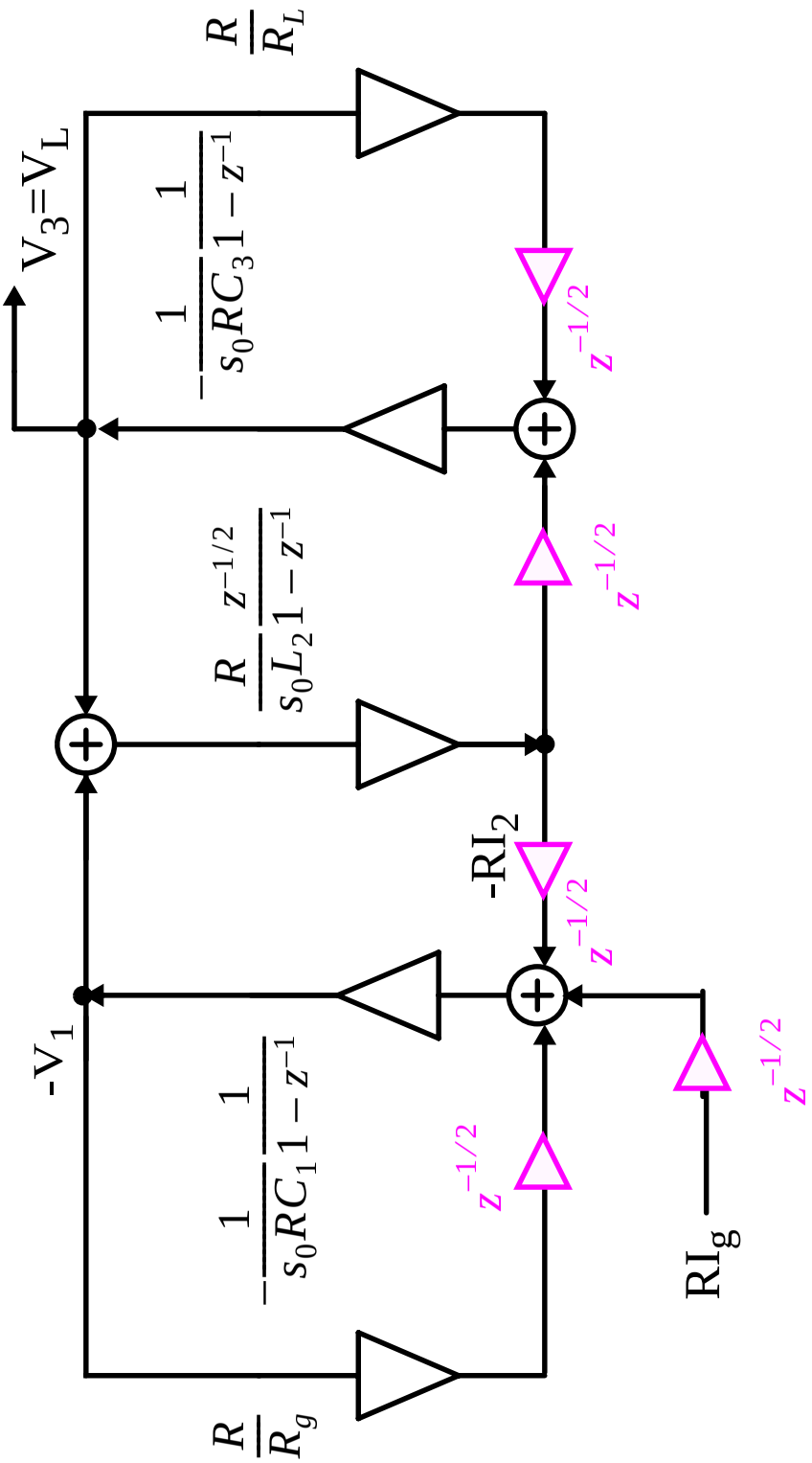
Modified signal flow graph



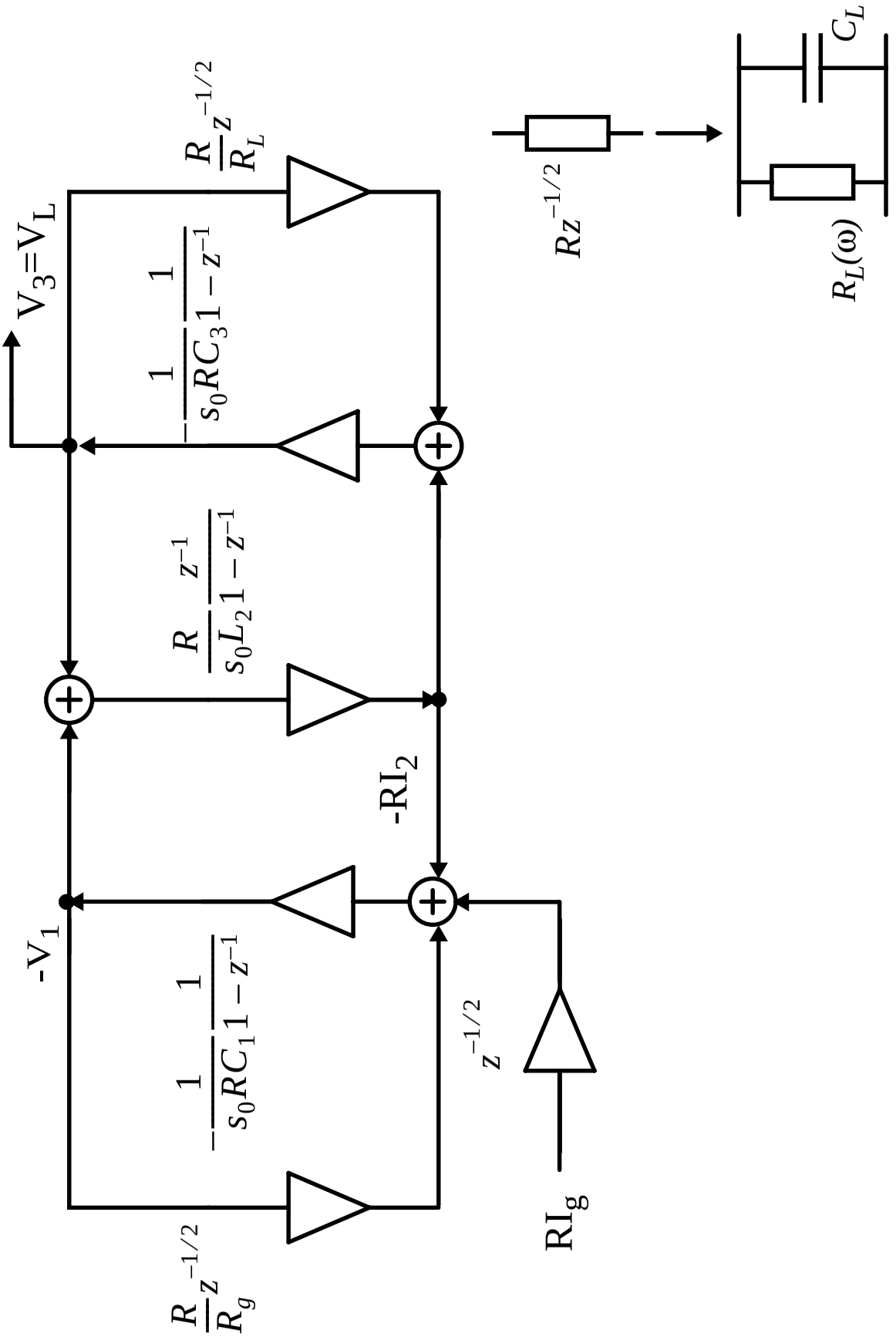
LDI transf. of Butterworth leapfrog



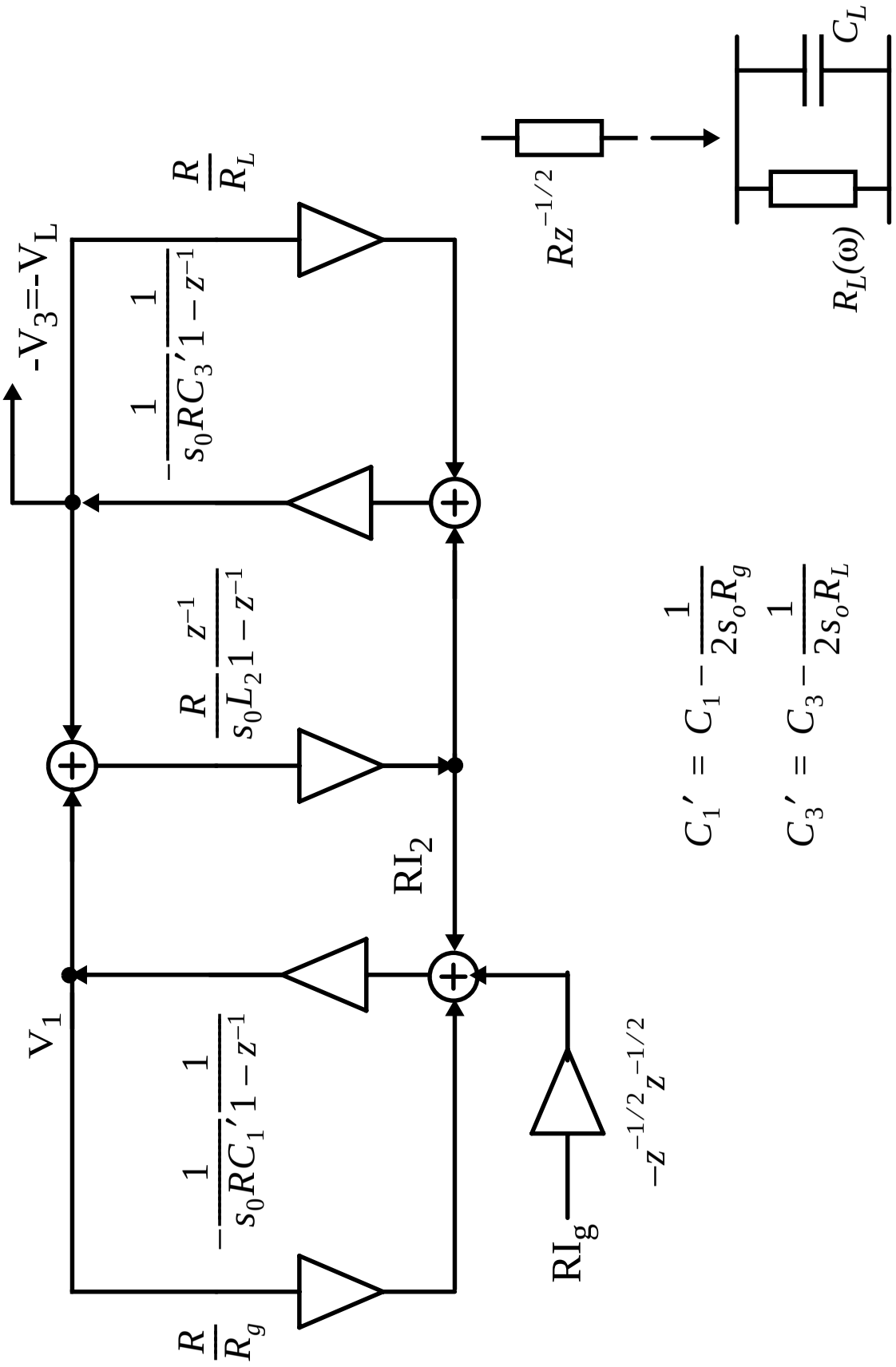
Modified signal flow graph



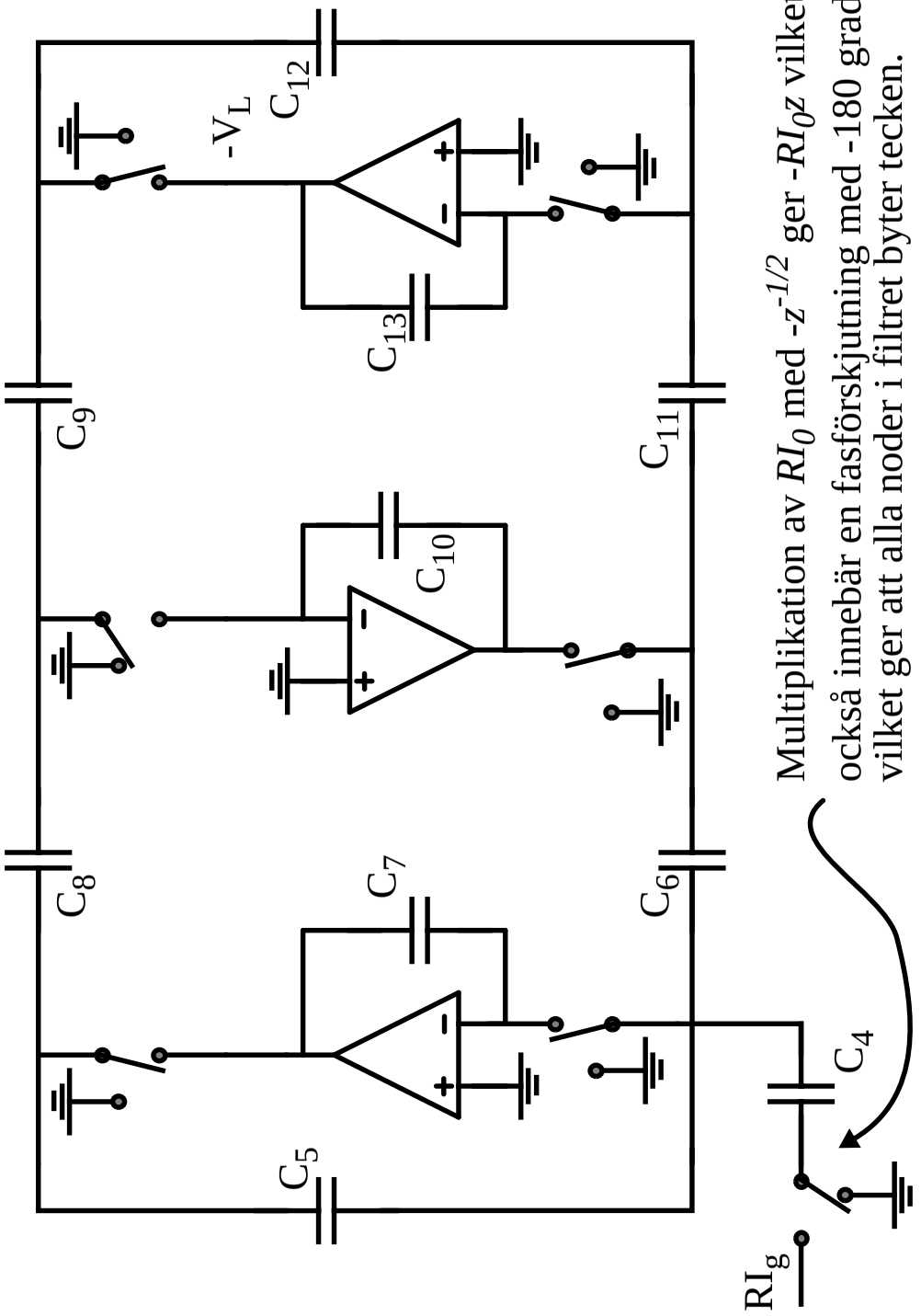
LDI transf. of Butterworth leapfrog filter



Elimination of signal-dependent resistances



SC realization

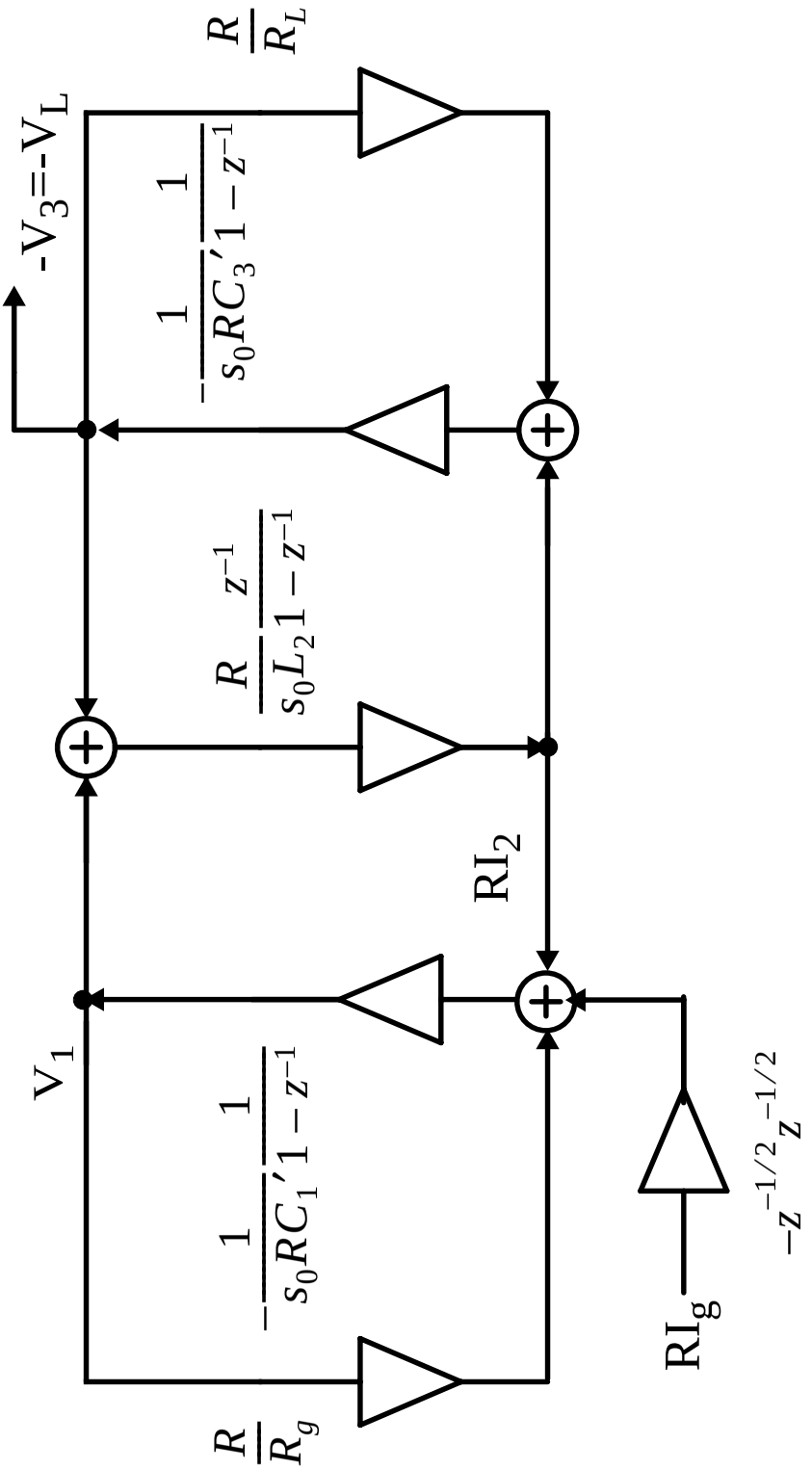
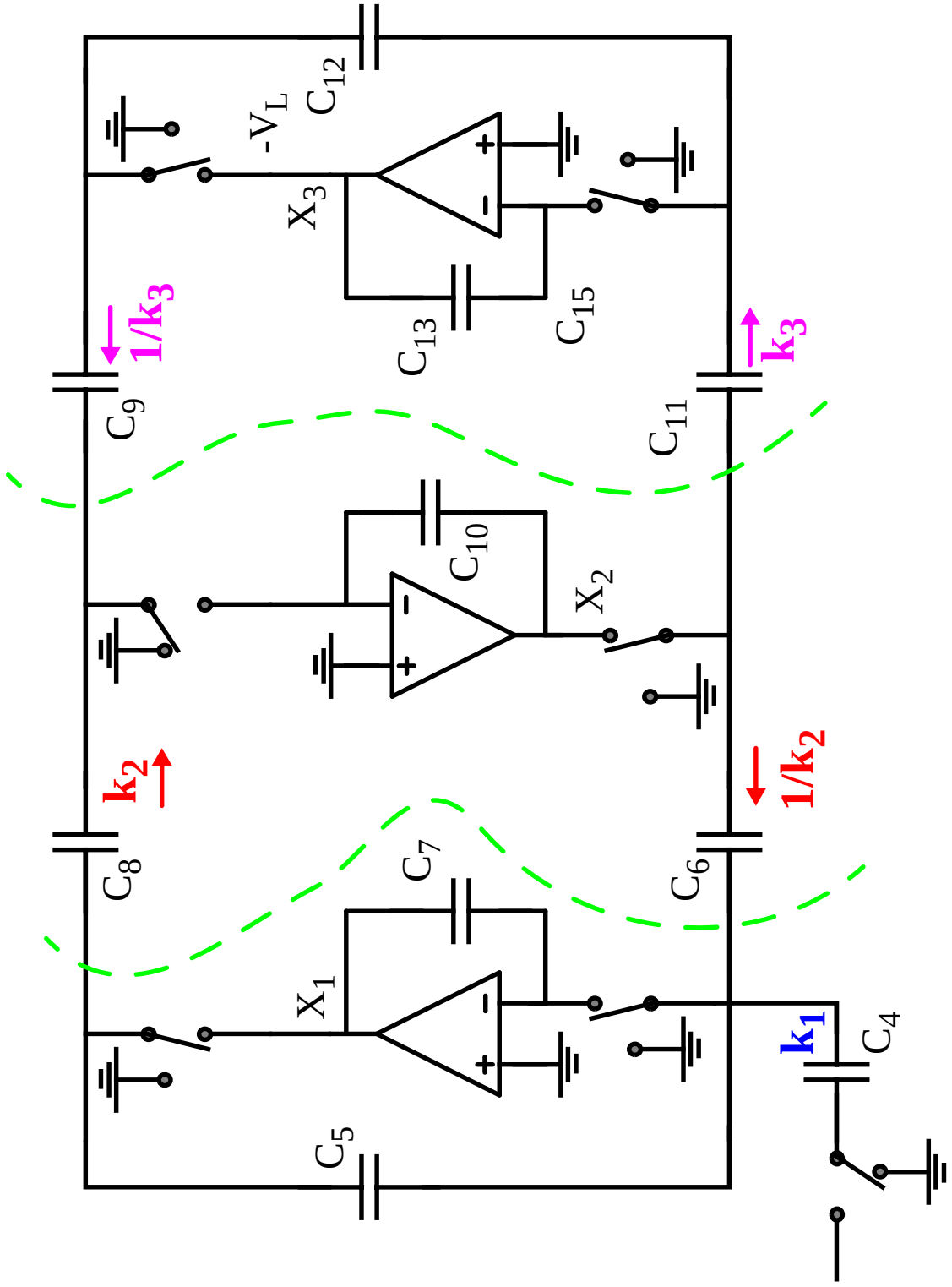


Identify signal paths

SC-filter	Signalflödesschema	Resultat
$[V_1]_{RI_g} = \frac{C_4}{C_7}\frac{z^{-1}}{1-z^{-1}}$	$[V_1]_{RI_g} = \frac{1}{s_0 RC_1'}\cdot\frac{z^{-1}}{1-z^{-1}}$	$\frac{C_4}{C_7} = \frac{1}{s_0 RC_1'}$
$[V_1]_{RI_2} = -\frac{C_6}{C_7}\frac{1}{1-z^{-1}}$	$[V_1]_{RI_2} = -\frac{1}{s_0 RC_1'}\frac{1}{1-z^{-1}}$	$\frac{C_6}{C_7} = \frac{1}{s_0 R\alpha_1 C_1'}$
$[V_1]_{V_1} = -\frac{C_5}{C_7}\frac{1}{1-z^{-1}}$	$[V_1]_{V_1} = -\frac{1}{s_0 RC_1'}\frac{R}{R_i}\frac{1}{1-z^{-1}}$	$\frac{C_5}{C_7} = \frac{1}{s_0 R_i C_1'}$
$[RI_2]_{V_1} = \frac{C_8}{C_{10}}\frac{z^{-1}}{1-z^{-1}}$	$[RI_2]_{V_1} = \frac{R}{s_0 L_2}\frac{z^{-1}}{1-z^{-1}}$	$\frac{C_8}{C_{10}} = \frac{R}{s_0 L_2}$
$[RI_2]_{-V_3} = \frac{C_9}{C_{10}}\frac{z^{-1}}{1-z^{-1}}$	$[RI_2]_{-V_3} = \frac{R}{s_0 L_2}\frac{z^{-1}}{1-z^{-1}}$	$\frac{C_9}{C_{10}} = \frac{R}{s_0 L_2}$
$[-V_3]_{RI_2} = -\frac{C_{11}}{C_{13}}\cdot\frac{1}{1-z^{-1}}$	$[-V_3]_{RI_2} = -\frac{R}{R_L}\cdot\frac{1}{s_0 RC_3}\cdot\frac{1}{1-z^{-1}}$	$\frac{C_{11}}{C_{13}} = \frac{1}{s_0 R_L C_3'}$
$[-V_3]_{-V_3} = -\frac{C_{12}}{C_{13}}\frac{1}{1-z^{-1}}$	$[-V_3]_{-V_3} = -\frac{R}{R_L}\cdot\frac{1}{s_0 RC_3}\cdot\frac{1}{1-z^{-1}}$	$\frac{C_{12}}{C_{13}} = \frac{1}{s_0 R_L C_3'}$

Dessutom kan antas att $R_i = R_L = R$

Scaling of signal flow graph



Discrete-time filter scaling