Chebyschev Filter (Z-domain) Zchebyi

Implementation of a lowpass or bandpass Chebyschev filter using a z-domain technique to enabling modeling of a high-order and/or narrow bandwidth filter. Fixed time-step transient analysis must be used

Figure 1: A Chebyschev Z-Domain filter element implemented as a voltage-controlled voltage source.

Form:
`Zchebyi`:⟨`instance name`⟩ n_1 n_2 n_3 n_4 ⟨`parameter list`⟩
n_1, n_2 $\cdots$ are the element nodes.

Parameters:

Parameter	Type	Default	Required?
flp: Lower Pass Frequency (Hz)	DOUBLE	0	reqd. if fo and pbw not specified
fhp: Upper Pass Frequency (Hz)	DOUBLE	0	reqd. if fo and pbw not specified
fo: Center Frequency (Hz)	DOUBLE	0	reqd. if flp and fhp not specified
pbw: Passband bandwidth (Hz or %)	DOUBLE	0	reqd. if flp fhp are not specified
pbfdb: Passband Flatness (negative) (dB)	DOUBLE	−3	optional
fls: Lower Stop Frequency (Hz)	DOUBLE	0	reqd. if pord not specified
fhs: Upper Stop Frequency (Hz)	DOUBLE	0	reqd. if pord not specified
sbadb: Stopband Attenuation (negative) (dB)	DOUBLE	−10	reqd. if pord not specified
pord: Lowpass Prototype Filter Order	INTEGER	0	reqd. if fls & fhs & sbadb not specified
ildb: Insertion Loss (negative) (dB)	DOUBLE	0	no
rep: Record filter design info in report	BOOLEAN	FALSE	optional

Notes on Parameters:

Lowpass filter is chosen if `fo` and `pbw` are not set, and `flp` = 0. Then `fhp` is the corner frequency of the lowpass filter. Note that `fhs` must be set.

Bandpass filter is chosen by setting either ((`flp`≠ 0) AND `fhp`) OR (`fo` AND `pbw`)

Description:
This is a v-to-v transducer implementing a unilateral Z-domain Butterworth lowpass or bandpass discrete-time filter. The sampling frequency of the filter is fixed to the time-step, `tstep`, of transient simulation. Note that this filter will not work with variable time-stepping! Also, the 'DC gain' of the filter is 1.

The order of the filter is determined by the netlist specifications. Implementation of the filter is in cascade form of conjugate pole pair blocks for even order filters. Odd order filters put the single real pole block at the front of the cascade of pole pair blocks for best numerical properties.

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Credits:

Name	Affiliation	Date	Links
Frank P. Hart	NC State University	Jan. 24, 2005	NC STATE UNIVERSITY
Michael B. Steer	NC State University	Jan. 5, 2008	NC STATE UNIVERSITY
			www.ncsu.edu