abmButterbpf10 abmbutterbpf10

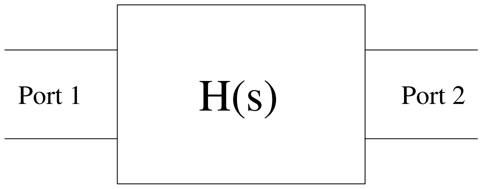

Figure 1: Butterbpf10 – Butterworth bandpass filter, tenth-order.

Form: `abmbutterbpf10:⟨instance name⟩` n_1 n_2 n_3 n_4 `⟨parameter list⟩`

n_1 is the positive terminal of port 1,

n_2 is the negative terminal of port 1,

n_3 is the positive terminal of port 2,

n_4 is the negative terminal of port 2.

Parameters:

Parameter	Type	Default value	Required?
f0: Filter center frequency (Hertz)	DOUBLE	N/A	yes
bw: Filter 3 dB bandwidth (Hertz)	DOUBLE	N/A	yes

Example:

```
abmButterbpf10:f1 11 0 20 0 f0=1e3 bw=200
```

Notes:

This element is a tenth-order Butterworth bandpass filter. The transfer function is in the form of a transconductance so that the output of the filter is a current at port two, controlled by the voltage at port one. The transfer function is expressed as sum of rational fractions of the following form:

$$H_i = \frac{a_i s^3 + b_i s^2 + c_i s}{s^4 + d_i s^3 + e_i s^2 + f_i s + h_i} \tag{1}$$

The coefficients of each of the five rational fractions in the implementation of this filter are computed at object initialization from the user-defined center frequency and bandwidth.

The element works in both Harmonic Balance and AC analysis simulations for any frequency, but due to limitations in the linear solver package, the time domain MNAM becomes unfactorable when the center frequency is set above 50 kHz. Also, when performing simulations in the time domain, the trapezoidal integration method does not converge for this element so the backward Euler method must be used.

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Credits:

Name	Affiliation	Date	Links
Aaron L. Walker	NC State University	April 2003	NC STATE UNIVERSITY
alwalke3@ncsu.edu			www.ncsu.edu