Bandwidth Control of Band Elimination Filters by Using Quasi-Symmetric Foster/Non-Foster Circuits

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Negative impedance converters (NICs), originally proposed by J. G. Linvill (Proc. IRE, vol. 41, pp.725-729, June 1953), have attractive features to produce negative impedances such as negative capacitances and negative inductances. Such circuit elements are called *Non-Foster* elements in order to distinguish them from the conventional elements that meet the Foster theorem. We have reported that band elimination filters composed of symmetrically allocated Foster/Non-Foster elements create a super-selective pulse-like stop band response, together with a flat phase behaviour (IEICE of Japan, General Conf., March 2013).

We newly propose a new scheme to control a bandwidth of the Foster/Non-Foster band elimination filters by degrading its symmetric composition. Fig. 1 shows circuit patterns of two-stage band elimination filters composed of symmetrically allocated Foster elements (Fig.1(a)), symmetrically allocated Foster/Non-Foster elements (Fig.1(b)), and quasi-symmetrically allocated Foster/ Non-Foster elements (Fig.1(c)). Their scattering characteristics and phase responses, calculated by a circuit simulator *LT-Spice*, are shown in Fig.1(d), which indicates that symmetric architecture produces the pulse-like stop band as mentioned above. However, by changing the capacitance slightly from the ideal value (e.g. 68pF −> 60pF), the bandwidth increases gradually. Noted that the passband obtained by the quasi-symmetric circuit can be narrower than that of the conventional one (Fig. 1(a)). This attractive feature can be applied to design new types of super narrower band elimination filters. (This work was supported by JSPS KAKENHI 22109002)

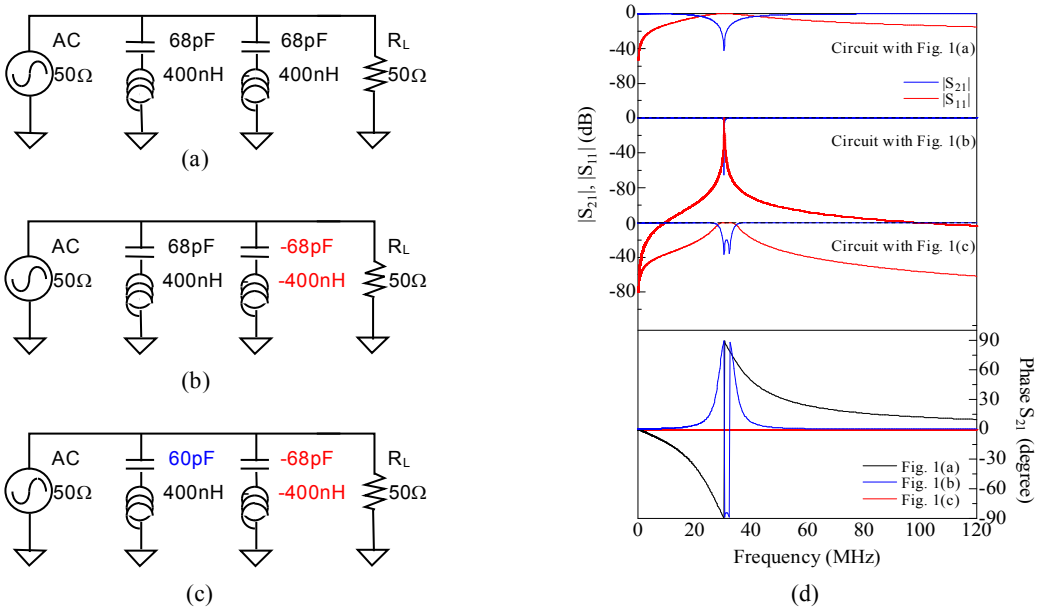

Fig. 1 Circuit patterns of band elimination filters, and their responses. (a) Foster circuit. (b) Symmetric Foster/Non-Foster circuit. (c) Quasi-symmetric circuit. (b) Scattering characteristics and phase responses.