

Designing On-Chip Active RC Filters for the Analog Front End (AFE).

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Abstract

Since the early days of microminiaturization in the 1960' and 70's, the design and implementation of filters has presented a special problem. The reason for this is mainly that conventional LCR filters, and in particular, inductors, cannot be miniaturized, let alone integrated, on a chip. Thus, for the last forty years or so, inductorless alternatives to LCR filters that are compatible with microminiaturization and on-chip integration have been developed. This continues to be necessary because, in spite of the 'digital revolution', the so-called 'analog front end' (AFE) of most electronic devices which interface with the real world is, and will continue to be, analog.

In this talk, a brief historical overview of the many attempts at finding inductorless filters will first be given. The overview ranges from hybrid-integrated thin- and thick-film circuits of the 60's and 70's, to switched-capacitor and switched-current filters of the 80's and 90's, and on to the present-day continuous-time active RC filters that are amenable to mixed-mode on-chip implementation.

Some of the main present-day methods of designing active RC filters for on-chip design will be covered. These methods cover signal-flow graph simulation of LC ladder filters, multi-amplifier biquads, ladder-biquad combinations, and the design of frequency-dependent capacitors and inductors. Examples from the area of high-speed wire-bound digital data communication systems (ADSL and VDSL) will be given.