

A TWO-LEVEL PIPELINED IMPLEMENTATION OF DIRECT-FORM RECURSIVE FILTERS

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ABSTRACT

A stabilized parallel algorithm for direct-form recursive filters is obtained using a new method of derivation in the Z domain. The algorithm is regular and modular, so very efficient VLSI architectures can be constructed to implement it. The degree of parallelism in these implementations can be chosen freely, and is not restricted to be a power of two.

COMMENTS

Only the Abstract is given here. The full report appeared as [3], and a revision appeared as [4]. For related work, see [1, 2].

REFERENCES

- [1] B. B. Zhou and R. P. Brent, "An efficient architecture for solving the recursive convolution equation with high throughput", *Proc. First IASTED International Symposium on Signal Processing and its Applications* (edited by B. Boashash), Institution of Engineers, Australia, Vol. 2, 1987, 771–775. ISBN 0-8581-4143-4. rpb099.
- [2] B. B. Zhou and R. P. Brent, "A high throughput systolic implementation of the second order recursive filter", *Proceedings IEEE 1988 Conference on Acoustics, Speech and Signal Processing* (New York, April 1988). Also appeared as Report TR-CS-88-04, Computer Sciences Laboratory, ANU, February 1988, 14 pp. rpb103.
- [3] B. B. Zhou and R. P. Brent, *A Two-level Pipelined Implementation of Direct-form Recursive Filters*, Report TR-CS-88-06, Computer Sciences Laboratory, ANU, April 1988, 16 pp. rpb104.
- [4] R. P. Brent and B. B. Zhou, "A stabilized parallel algorithm for direct-form recursive filters", *IEEE Transactions on Computers* 40 (1991), 333–336. Also appeared as *A stabilized parallel implementation of direct-form recursive filters*, Report TR-CS-88-07, Computer Sciences Laboratory, ANU, May 1988, 9 pp. rpb105.

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