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Automatic Design of Analog Filter
Using Genetic Algorithm

Background
Specifications for the analog circuits have increased rapidly in recent years.
However, the more complicated the circuit configuration becomes, the more difficult it gets for an engineer to design.

This method can be expected to design complex circuits quickly.

Research Goal
Output of any phase can be achieved for the analog filter working in any frequency band.

Using genetic algorithm

Automatic design algorithm & software for analog filters

Genetic Algorithm
A superior gene survives, while an inferior gene is weeded out in the process of biological evolution.

Expressed in Algorithm

Create Individuals
- Create Individuals
- Crossover
- Mutation
- Create New Individuals

Circuit Configuration to Apply the Genetic Algorithm
Using switch operation of ON & OFF

Target Specification 1:
Automatically design an analog filter that generates constant phase of ±112[rad] for a frequency band of 100MHz to 300MHz

Target Specification 2:
Automatically design an analog filter that generates constant phase of ±116[rad] for a frequency band of 100MHz to 300MHz

Conditions of automated design:
- Population: 100
- Generation: 300
- Crossover rate: 60%
- Mutation rate: 10%

Evaluation of Result
The error rate is less than 5% for all the points
There is any point indicating an error rate of more than 5%

The condition is satisfied
The condition is not satisfied

Result of Automatic Design
- Fixed phase of ±112[rad]
- Fixed phase of ±116[rad]

Conclusion
- We have proposed an automated design of an analog filter that satisfies target specification
- Frequency band of 100MHz to 300MHz, the target specification of constant phase has been fulfilled
- Utilizing this new designing method
- Automatic designing of various kinds of Filter circuit is possible

References