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Mixed Scattering Matrix: Properties and Applications

Outline

1. Admittance, Wave Scattering, and Mixed Scattering Matrices of the Multi-Port Network

- 1.1. General definition of the mixed scattering matrix
- 1.2. Relationship between generalized wave amplitudes and electric variables
- 1.3. Conversion between admittance, wave scattering, and mixed scattering matrices
- 1.4. Reciprocity and power conservation
- 1.5. Reference plane transformation

2. Mixed Scattering Matrix of a SAW Transducer

- 2.1. Three-Port representation of a SAW transducer
- 2.2. Physical meaning of the mixed scattering matrix
- 2.3. Mixed scattering matrix elements
- 2.4. Conversion to the wave scattering matrix
- 2.5. Properties of the reciprocal and lossless SAW transducer
- 2.6. Conversion between mixed scattering and transmission matrices

3. SAW Filter Simulation

- 3.1. Statement of the problem
- 3.2. Cascading mixed scattering matrices
- 3.3. Cascading mixed transmission matrices
- 3.4. SAW filter S -parameters

4. Modeling in the Quasi-Static Approximation

- 4.1. Closed-form mixed scattering matrix and transmission matrix
- 4.2. Acoustoelectric conversion function
 - 4.2.1. Generalized wave amplitude
 - 4.2.2. Closed-form equations
- 4.3. Unapodized Periodic SAW Transducers
 - 4.3.1. Basic structure and guard electrodes
 - 4.3.2. Contribution of the guard electrodes to the acoustoelectric conversion
 - 4.3.3. Finger and gap taps
 - 4.3.4. Element factor
 - 4.3.5. Misusing finger taps
 - 4.3.6. Merits of gap taps against finger taps
- 4.4. Apodized Periodic SAW Transducers
 - 4.4.1. Basic modeling assumptions
 - 4.4.2. Generalization of finger and gap taps
- 4.5. Example of bidirectional SAW filter simulation

5. Modeling of Reflective SAW Transducers (COM-analysis)

- 5.1. Basic model equations
- 5.2. Mixed scattering matrix (COM-model)
- 5.3. Example of COM-analysis of SAW transducer

6. Conclusions