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Samuel Seely – *An Introduction to Engineering Systems*

Part I: Models and Modeling

1. Modeling System Elements
 - Model characteristics and approximations
 - Signals and waveforms
 - Electrical elements (resistors, inductors, capacitors)
 - Mechanical elements (mass, spring, damper)
 - Fluid and thermal systems
 - Transducers and active networks

Part II: Interconnected Systems

2. Equilibrium Formulations
 - Kirchhoff's laws
 - State variables
 - State equations
 - Continuous and sampled-data systems
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4. System Geometry and Constraint Equations
 - Connection matrices
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 - System duality

Part III: System Response

Time-Domain Analysis

5. System Response
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 - Numerical methods
 - Analog and digital simulation
6. General Considerations of Time Response
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 - Response to periodic inputs

Frequency-Domain Analysis

7. Laplace Transform
8. The s-Plane: Poles and Zeros
9. Sinusoidal Response
 - Bode diagrams
 - Bandwidth
 - Quality factor (Q)
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- Thévenin and Norton theorems
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- Hybrid parameters

11. General Excitation Functions

- Fourier series
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Part IV: Advanced Topics

12. Z-Transform and Discrete Systems

13. System Stability

- Routh-Hurwitz criterion
- Nyquist criterion
- Controllability and observability
- Lyapunov stability