Momentum First and Gauss (nearly) Last

Mechanics & Thermal Physics

The Momentum Principle
- Ch. 1: Interactions; 3D vectors; velocity; momentum
- Ch. 2: The Momentum Principle; iterative techniques;
\[ \vec{p}_f = \vec{p}_i + \vec{F}_{net} \Delta t \]
- Ch. 3: Fundamental interactions; momentum in collisions
- Ch. 4: Contact interactions; ball-and-spring model of solids;
\[ \frac{d\vec{p}}{dt} = \vec{F}_{net}; \text{harmonic oscillator} \]
- Ch. 5: Determining forces from motion

The Energy Principle
\[ E_f = E_i + W + Q + \cdots \]
- Ch. 6: Energy in relativistic context
- Ch. 7: Internal energy; dissipative forces
- Ch. 8: Energy quantization
- Ch. 9: Translational, rotational, and vibrational energy;
point-particle and extended systems
- Ch. 10: Collisions (momentum and energy conservation)

The Angular Momentum Principle
\[ \vec{L}_f = \vec{L}_i + \vec{r}_{net} \Delta t \quad \text{or} \quad \frac{d\vec{L}}{dt} = \vec{r}_{net} \]
- Ch. 11: Angular momentum; torque; conservation

The Fundamental Assumption of Statistical Mechanics
- Ch. 12: Entropy; temperature; specific heat

Electricity & Magnetism

Stationary Charges
- Ch. 13: Electric field (force and energy in Mechanics)
- Ch. 14: Electric fields and matter
- Ch. 15: Electric field of distributed charges
- Ch. 16: Electric potential

Moving Charges
- Ch. 17: Magnetic field
- Ch. 18: Electric field and circuits
- Ch. 19: Circuit elements
- Ch. 20: Magnetic force (includes motional emf)

Patterns of Field in Space
- Ch. 21: Gauss’s law; Ampere’s law

Time-varying Magnetic Field
- Ch. 22: Faraday’s law (curly field with nonzero \( d\vec{B}/dt \))

Accelerated Charges
- Ch. 23: Ampere-Maxwell law; production, propagation, and effects of electromagnetic radiation

For further information: matterandinteractions.org