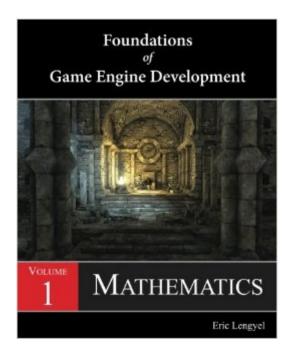
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Foundations Of Game Engine Development, Volume 1: Mathematics





Synopsis

The first volume of Foundations of Game Engine Development discusses the mathematics needed by engineers who work on games or other types of virtual simulations. The book begins with conventional treatments of topics such as linear algebra, transforms, and geometry. Then, it introduces Grassmann algebra and geometric algebra to provide a much deeper understanding of the subject matter and highlight the places where traditional arithmetic with vectors, matrices, quaternions, etc., isn't quite correct. Includes exercises. Chapter 1: Vectors and Matrices 1.1 Vector Fundamentals 1.2 Basic Vector Operations 1.2.1 Magnitude and Scalar Multiplication 1.2.2 Addition and Subtraction 1.3 Matrix Fundamentals 1.4 Basic Matrix Operations 1.4.1 Addition, Subtraction, and Scalar Multiplication 1.4.2 Matrix Multiplication 1.5 Vector Multiplication 1.5.1 Dot Product 1.5.2 Cross Product 1.5.3 Scalar Triple Product 1.6 Vector Projection 1.7 Matrix Inversion1.7.1 Identity Matrices1.7.2 Determinants1.7.3 Elementary Matrices1.7.4 Inverse Calculation 1.7.5 Inverses of Small Matrices Chapter 2: Transforms 2.1 Coordinate Spaces 2.1.1 Transformation Matrices 2.1.2 Orthogonal Transforms 2.1.3 Transform Composition 2.2 Rotations 2.2.1 Rotation About a Coordinate Axis 2.2.2 Rotation About an Arbitrary Axis 2.3 Reflections 2.4 Scales 2.5 Skews 2.6 Homogeneous Coordinates 2.7 Quaternions 2.7.1 Quaternion Fundamentals2.7.2 Rotations With QuaternionsChapter 3: Geometry3.1 Triangle Meshes3.2 Normal Vectors 3.2.1 Calculating Normal Vectors 3.2.2 Transforming Normal Vectors 3.3 Lines and Rays3.3.1 Parametric Lines3.3.2 Distance Between a Point and a Line3.3.3 Distance Between Two Lines3.4 Planes3.4.1 Implicit Planes3.4.2 Distance Between a Point and a Plane3.4.3 Reflection Through a Plane3.4.4 Intersection of a Line and a Plane3.4.5 Intersection of Three Planes3.4.6 Intersection of Two Planes3.4.7 Transforming Planes3.5 PIA cker Coordinates3.5.1 Implicit Lines3.5.2 Homogeneous Formulas3.5.3 Transforming LinesChapter 4: Advanced Algebra4.1 Grassmann Algebra4.1.1 Wedge Product4.1.2 Bivectors4.1.3 Trivectors4.1.4 Algebraic Structure 4.1.5 Complements 4.1.6 Antivectors 4.1.7 Antiwedge Product 4.2 Projective Geometry 4.2.1 Lines4.2.2 Planes4.2.3 Join and Meet4.2.4 Line Crossing4.2.5 Plane Distance4.2.6 Summary and Implementation 4.3 Matrix Inverses 4.4 Geometric Algebra 4.4.1 Geometric Product 4.4.2 Vector Division4.4.3 Rotors4.5 Conclusion

Book Information

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