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This book consists of two parts,
different in form but similar in
spirit. The first, which comprises
chapters 0 through 9, is a revised
and somewhat enlarged version
of the 1972 book *Geometrie*

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Differentielle. The second part, chapters 10 and 11, is an attempt to remedy the notorious absence in the original book of any treatment of surfaces in three-space, an omission all the more unforgivable in that surfaces are some of the most common

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geometrical objects, not only in
mathematics but in many

branches of physics. Geometrie
Differentielle was based on a
course I taught in Paris in 1969-
70 and again in 1970-71. In
designing this course I was
decisively influenced by a

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conversation with Serge Lang,
and I let myself be guided by
three general ideas. First, to
avoid making the statement and
proof of Stokes' formula the
climax of the course and running
out of time before any of its
applications could be discussed.

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Second, to illustrate each new notion with non-trivial examples, as soon as possible after its introduction. And finally, to familiarize geometry-oriented students with analysis and analysis-oriented students with geometry, at least in what

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concerns manifolds.

Our first knowledge of
differential geometry usually
comes from the study of the
curves and surfaces in \mathbb{R}^3
that arise in calculus. Here we
learn about line and surface
integrals, divergence and curl,

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and the various forms of Stokes' Theorem. If we are fortunate, we may encounter curvature and such things as the Serret-Frenet formulas. With just the basic tools from multivariable calculus, plus a little knowledge of linear algebra, it is possible to begin a

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much richer and rewarding study of differential geometry, which is what is presented in this book. It starts with an introduction to the classical differential geometry of curves and surfaces in Euclidean space, then leads to an introduction to the Riemannian

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Mathematicae. An important

bridge from the low-dimensional

theory to the general case is

provided by a chapter on the

intrinsic geometry of surfaces.

The first half of the book,

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covering the geometry of curves
and surfaces, would be suitable
for a one-semester

undergraduate course. The local
and global theories of curves and
surfaces are presented, including
detailed discussions of surfaces
of rotation, ruled surfaces, and

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minimal surfaces. The second half of the book, which could be used for a more advanced course, begins with an introduction to differentiable manifolds, Riemannian structures, and the curvature tensor. Two special topics are treated in detail:

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spaces of constant curvature and Einstein spaces. The main goal of the book is to get started in a fairly elementary way, then to guide the reader toward more sophisticated concepts and more advanced topics. There are many examples and exercises to help

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along the way. Numerous figures help the reader visualize key concepts and examples, especially in lower dimensions. For the second edition, a number of errors were corrected and some text and a number of figures have been added.

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Differential geometry began as the study of curves and surfaces using the methods of calculus. In time, the notions of curve and surface were generalized along with associated notions such as length, volume, and curvature. At the same time the topic has

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Mathematics
become closely allied with
developments in topology. The
basic object is a smooth manifold,
to which some extra structure
has been attached, such as a
Riemannian metric, a symplectic
form, a distinguished group of
symmetries, or a connection on

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the tangent bundle. This book is
a graduate-level introduction to

the tools and structures of
modern differential geometry.

Included are the topics usually
found in a course on

differentiable manifolds, such as
vector bundles, tensors,

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differential forms, de Rham cohomology, the Frobenius theorem and basic Lie group theory. The book also contains material on the general theory of connections on vector bundles and an in-depth chapter on semi-Riemannian geometry that covers

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basic material about Riemannian
manifolds and Lorentz manifolds.

An unusual feature of the book is
the inclusion of an early chapter
on the differential geometry of
hyper-surfaces in Euclidean
space. There is also a section that
derives the exterior calculus

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version of Maxwell's equations.

The first chapters of the book are
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Mathematics suitable for a one-semester
course on manifolds. There is
more than enough material for a
year-long course on manifolds
and geometry.

Elementary Differential

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Geometry focuses on the elementary account of the geometry of curves and surfaces. The book first offers information on calculus on Euclidean space and frame fields. Topics include structural equations, connection forms, frame fields, covariant

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derivatives, Frenet formulas,
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curves, mappings, tangent
vectors, and differential forms.

The publication then examines
Euclidean geometry and calculus
on a surface. Discussions focus
on topological properties of
surfaces, differential forms on a

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surface, integration of forms, differentiable functions and tangent vectors, congruence of curves, derivative map of an isometry, and Euclidean geometry. The manuscript takes a look at shape operators, geometry of surfaces in E , and

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Riemannian geometry. Concerns include geometric surfaces, covariant derivative, curvature and conjugate points, Gauss-Bonnet theorem, fundamental equations, global theorems, isometries and local isometries, orthogonal coordinates, and

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integration and orientation. The
text is a valuable reference for

students interested in elementary
differential geometry.

Elements of Differential Topology
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Modeling of Curves and Surfaces

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with MATLAB®

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curves and surfaces as well as
their applications in a variety of
disciplines. This book presents

elementary methods for

analytical modeling and
demonstrates the potential for

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support the development of analytical solutions. The author systematically examines several powerful tools of MATLAB® including 2D and 3D animation of geometric images with shadows and colors and transformations

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traditional differential and non-
Euclidean geometries with more
current computer systems in a
practical and user-friendly

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format. This text is an excellent classroom resource or self-study reference for undergraduate students in a variety of disciplines.

Derived from the author's course on the subject, Elements of

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of manifold theory, and
concludes with discussions on
algebraic topol

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differential geometry from curves

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and surfaces to manifolds in general. The book provides a broad introduction to the field of differentiable and Riemannian manifolds, tying together classical and modern formulations. It introduces

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manifolds in a both streamlined
and mathematically rigorous way
while keeping a view toward
applications, particularly in
physics. The author takes a
practical approach, containing
extensive exercises and focusing

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in context and encourage the student to consult original sources and discover additional important ideas there. For this second edition, Professor Struik made some corrections and added an appendix with a sketch

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of the application of Cartan's method of Pfaffians to curve and surface theory. The result was to further increase the merit of this stimulating, thought-provoking text — ideal for classroom use, but also perfectly suited for self-

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other sciences. The book is based on lectures the author held repeatedly at Novosibirsk State University. It is addressed to students as well as to anyone who wants to learn the basics of differential geometry.

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way, Modern Differential
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define and compute standard
geometric functions using
Mathematica for constructing
new curves and surfaces from
existing ones. Since Gray's
death, authors Abbena and
Salamon have stepped in to

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bring the book up to date. While maintaining Gray's intuitive approach, they reorganized the material to provide a clearer division between the text and the Mathematica code and added a Mathematica notebook as an

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appendix to each chapter. They also address important new topics, such as quaternions. The approach of this book is at times more computational than is usual for a book on the subject. For example, Brioschi's formula for

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the Gaussian curvature in terms of the first fundamental form can be too complicated for use in hand calculations, but Mathematica handles it easily, either through computations or through graphing curvature.

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and surfaces. The transition from classical differential geometry as developed by Gauss, Riemann and other giants, to the modern approach, is facilitated by a very intuitive approach that sacrifices some mathematical rigor for the sake of

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understanding the physics. The book features numerous examples of beautiful curves and surfaces often reflected in nature, plus more advanced computations of trajectory of particles in black holes. Also embedded in the later chapters is a detailed

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with periodic curvature
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Kobayashi, who taught at
U.C. Berkeley for 50
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by Eriko Shinozaki Nagumo
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There are five chapters:
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5. Minimal Surfaces.

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Chapter 1 discusses local and global properties of planar curves and curves in space. Chapter 2 deals with local properties of surfaces in 3-dimensional Euclidean space. Two types

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Gaussian curvature K and
the mean curvature H –are
introduced. The method of
the moving frames, a
standard technique in
differential geometry, is

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introduced in the context
of a surface in

3-dimensional Euclidean
space. In Chapter 3, the
Riemannian metric on a
surface is introduced and
properties determined only

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by the first fundamental
form are discussed. The
concept of a geodesic
introduced in Chapter 2 is
extensively discussed, and
several examples of
geodesics are presented

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of Stokes' theorem for a
domain. Then the
Gauss–Bonnet theorem, the
major topic of this book,

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is discussed at great length. The theorem is a most beautiful and deep result in differential geometry. It yields a relation between the integral of the Gaussian

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curvature over a given oriented closed surface S and the topology of S in terms of its Euler number $\chi(S)$. Here again, many illustrations are provided to facilitate the reader's

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understanding. Chapter 5,
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some elementary knowledge
of complex analysis.

However, the author
retained the introductory
nature of this book and

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focused on detailed
explanations of the
examples of minimal
surfaces given in Chapter
2.

This book offers an
introduction to

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metric properties they inherit from it. Among the topics discussed are curvature and how it affects the shape of space, and the generalization of the

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fundamental theorem of
calculus known as Stokes'
theorem.

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