



# Mimetic Discretization Methods

*Jose E. Castillo, Guillermo F. Miranda*

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To help solve physical and engineering problems, mimetic or compatible algebraic discretization methods employ discrete constructs to mimic the continuous identities and theorems found in vector calculus.

**Mimetic Discretization Methods** focuses on the recent mimetic discretization method co-developed by the first author. Based on the Castillo-Grone operators, this simple mimetic discretization method is invariably valid for spatial dimensions no greater than three. The book also presents a numerical method for obtaining corresponding discrete operators that mimic the continuum differential and flux-integral operators, enabling the same order of accuracy in the interior as well as the domain boundary.

After an overview of various mimetic approaches and applications, the text discusses the use of continuum mathematical models as a way to motivate the natural use of mimetic methods. The authors also offer basic numerical analysis material, making the book suitable for a course on numerical methods for solving PDEs. The authors cover mimetic differential operators in one, two, and three dimensions and provide a thorough introduction to object-oriented programming and C++. In addition, they describe how their mimetic methods toolkit (MTK)—available online—can be used for the computational implementation of mimetic discretization methods. The text concludes with the application of mimetic methods to structured nonuniform meshes as well as several case studies.

Compiling the authors' many concepts and results developed over the years, this book shows how to obtain a robust numerical solution of PDEs using the mimetic discretization approach. It also helps readers compare alternative methods in the literature.

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