

Scientific Visualization & Simulation in Java with MDI

Building Interactive, Extensible Desktop Applications for Research and Education

Build interactive scientific simulations and visualizations in Java using MDI (Multi-Document Interface). This essential guide saves you from having to piece together disconnected UI recipes, offering a consolidated guide in which visualization, simulation, interaction, and extensibility fit together within a coherent design.

The book shows you how to build a complete Java desktop, structured around a series of demo applications that grow in complexity. Early chapters introduce core MDI concepts such as views, containers, layers, interactive items, and toolbars. From there, you'll be ready to explore simulation engines, scientific plotting (including histograms and curve fitting), multi-view coordination, and performance topics. Through clear explanations, you'll understand why key design decisions affect performance, maintainability, and extensibility, and how those choices scale real research and educational applications. A final capstone project shows you how to use MDI to build a full machine-learning desktop application with an ONNX-based classification model.

By the end of the book, you'll understand how to design responsive Java desktop applications, coordinate multiple visualizations, manage background computation safely, and extend a visualization framework for your own scientific or engineering domains.

What You Will Learn:

- Design maintainable, extensible Java desktop architecture for scientific and technical applications
- Build interactive visualizations that coordinate multiple views and shared data
- Integrate simulations, background computation, and UI responsiveness safely
- Implement scientific plotting, curve fitting, and histogram-based visualizations
- Extend a visualization framework for custom research or educational projects

Who This Book is for:

Scientific software developers, computational scientists, engineers, and students working on data-driven projects, as well as developers maintaining long-lived technical systems. Readers should be comfortable with core Java concepts and event-driven programming, but no prior experience with scientific visualization frameworks is required.

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