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Nirupam Chakraborti: Data-Driven Evolutionary Modeling in Materials Technology

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Computational methods are essential in materials science and technology, combining disciplines such as physics, mathematics, engineering, and informatics. Their application allows theoretical prediction of significant material properties enabling a computational design of new materials and process optimization. Prof. Nirupam Chakraborti is a world-recognized expert working in computational materials technology. The book "Data-Driven Evolutionary Modeling in Materials Technology" (CRC Press, 2023, Hardcover, 318 pages, ISBN: 978-1-032-06173-3) summarizes his many years of research and teaching in this area. Working in computational material science, I was interested in reviewing this book and learning about recent progress.

The book is well-structured and can be divided into two parts. Chapters 1–9 introduce the fundamentals of data-driven modeling, associated evolutionary algorithms, and several software solutions. Chapters 10–15 concentrate on applying these methods in numerous areas, such as metal manufacturing, the chemical industry, materials design, and computational materials science. The strength of this book is that it gives a comprehensive and practical overview of the application of evolutionary algorithms in these areas. Chakraborti briefly and comprehensibly introduces each example. For instance, in Chapters 12–15, the reader can find many physics-based models that predict material properties during manufacturing processes, such as rolling, welding and heat treatment. The construction of computational surrogate models is also discussed, and known challenges when using evolutionary algorithms are briefly addressed. The current edition considered many publications until 2021, while more recent developments could not be included.

The book is easy to read and has many illustrations. However, the printed figures' quality could have been improved. The book meets its target audience, i.e.,

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researchers, professionals, and postgraduate students working in materials development, metallurgical processing, computational materials science, and data-driven engineering. In particular, members of the research community working at the intersection of materials/process engineering and data science will benefit from reading this book. Non-experts can follow the description of the fundamentals and will get a good illustration of how evolutionary methods can be applied in materials science and engineering.

I can imagine giving the book to one of my students working in computational materials design. It can also be used in teaching as a complimentary reading for a post-graduate program. However, it is not a textbook, it requires specific background knowledge in the field and doesn't include exercises or lecture notes. Summarizing: I have enjoyed reading "Data-Driven Evolutionary Modeling in Materials Technology" and would recommend it to colleagues and collaborators from material science, materials technology, and data science.

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