

Laser Material Processing, 3rd ed.

William M. Steen
Springer-Verlag, London, Berlin,
Heidelberg, 2003

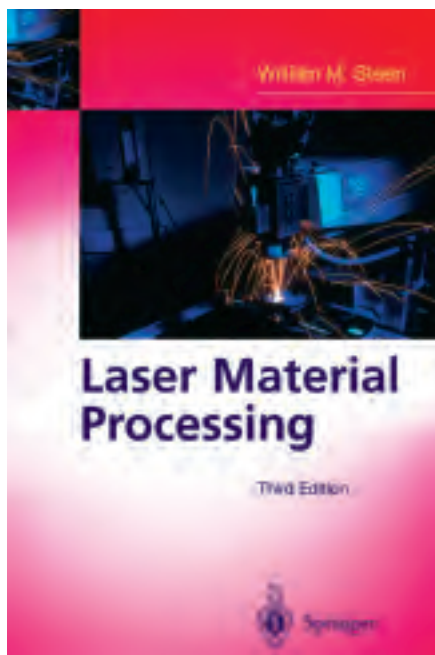
408 pp.
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Reviewed by Anatoliy Bekrenev

Since their inception 50 years ago, lasers have evolved from a source of high-intensity monochromatic radiation into a powerful tool in engineering and manufacturing. A focused laser beam is one of the highest-power-density sources available to industry today. Mechanically speaking, a laser beam is a nonwearing tool. A laser's high power and high density of energy make it useful in a wide range of manufacturing processes.

A laser processing system closely resembles a generic machine tool, where energy is transferred to a material under some form of control. There are two major laser material processing applications: applications requiring delivery to the workplace of limited and well-controlled amounts of energy, and applications requiring a substantial amount of energy to induce required transformations. Materials to be treated can be of any hardness, plasticity, or brittleness. Yet, despite all the achievements in laser material processing, laser technologies are still in their infancy.

In *Laser Material Processing*, William M. Steen notes that a laser must be reasonably powerful for material processing, which reduces the number of eligible lasers (based on about 15,000 types of laser oscillations) to only a few gas lasers, solid-state lasers, and semiconductor lasers. CO₂ lasers and Nd-YAG lasers, invented in 1964, are the most effective lasers for science and technology. These lasers are often used for various manufacturing processes and have the longest life. Steen points out that industrial lasers are effective for cutting, welding, surface heating, bending, melting, alloying, cladding, texturing, roughening, marking, cleaning, and so on. With the development of highly automated workstations with lasers—which cost less and are powerful, reliable, and compact—laser material pro-



cessing is set to become the fashion of the next decade.

To understand the capabilities and limitations of laser material processing, however, it is important to analyze the physical processes of the interaction between radiation and matter. These interactions are the basis for laser material processing applications. Unfortunately, the author does not discuss these interactions in depth, nor does he review materials science problems connected with laser reactions.

Laser Material Processing is a clear and instructive textbook for students who will become the next generation of laser specialists, and it is a good source of updated knowledge for practicing engineers and technicians in optoelectronics, laser processing, materials treatment, and advanced manufacturing. The book also will be helpful as a reference source. The chapters are largely independent of one another, and a reader interested in only one topic may be satisfied by reading all or parts of the relevant chapter without going to other chapters. Well written, with many useful diagrams and examples of industrial applications, Steen's book is a good guide in the field. □

Anatoliy Bekrenev is a professor of physics at National American University in Bloomington, Minnesota. He is currently researching the structure and mechanical properties of materials subjected to laser reactions (bekrenev@pro-ns.net).

The Isaac Newton School of Driving: Physics and Your Car

Barry Parker
The Johns Hopkins University Press,
Baltimore, 2003
250 pp.
ISBN 0-8018-7417-3

Reviewed by Henry J. P. Smith

Barry Parker has written an intriguing book. The son of a garage owner, he grew up with cars. He tells us that his fascination with the automobile nearly led him into a career as an automotive engineer. Later, as a physics professor, he included automotive topics in his teaching. In this book, Parker introduces the basic concepts of physics in terms of the car, thus appealing to a common interest of many people.




Parker starts with a brief history of the automobile, which he expands upon from time to time in later chapters. He then leads the reader on a tour of simple kinematics and mechanics, thermal physics, and the basics of electrical systems. The discussion is aimed at the “informed” reader, using a minimum of equations. He includes numerous diagrams and figures to illustrate his points. Material is sometimes introduced quite hastily, however; for example, he discusses uniform motion without clearly defining what that means.

Subsequent chapters return to mechanics, treating various aspects of automobiles in some nonmathematical detail. One chapter discusses braking systems and tires, and the next discusses gearing and transmission systems. Although these deal more with engineering, they are nonetheless interesting from a physics perspective. The discussion of the roll axis intrigued this reviewer: This is the axis about which the car might roll over in a high-speed turn, as do certain SUVs. The author focuses on rear-wheel-drive vehicles, yet it would have been useful to include a comparison with front-wheel-drive as well. The chapter on aerodynamics includes a discussion of the drag force and its increase with speed, as well as aerodynamic effects on stability.

No treatment of physics and cars could be complete without a discussion of collisions. Parker considers head-on collisions, whether completely inelastic or not, as well as two-dimensional collisions and the reconstruction of accidents. Unfortunately, this chapter introduces, rather abruptly, a "severity index" as a measure of the survivability of a crash, without adequately explaining the term.

Auto racing is another fascinating topic to which Parker devotes a chapter. He discusses traction and strategy and how to make the most effective turns in a race. Traffic is the final topic, with a brief consideration of chaos theory and complexity, both areas of current research in statistical physics. The final chapter looks ahead to automated highways and other new technologies.

The Isaac Newton School of Driving has a definite flair and keeps the reader interested. Despite a few minor flaws, the book should have broad appeal and could provide a good resource for those who teach elementary physics. 

Henry J. P. Smith is a part-time lecturer in physics at Northeastern University in Boston. Semi-retired, he worked for more than 30 years in industry, in atmospheric and infrared physics, and built large-scale computer codes for use in such studies (h.smith@neu.edu).



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