

# Foreword

## by Nick Holonyak, Jr.

After over 50 years of study and work as a semiconductor device scientist and engineer, and after having had the opportunity to witness so many startling developments since the time of John Bardeen and Walter Brattain's original transistor to now the transistor laser (which bears some relationship all the way back to Bardeen and Brattain's point contact transistor), I am able to look back with some depth and perspective at what areas of learning have been vital to us. I am talking about the areas of science and learning that have been at the heart of what we know and what we do, that which has supported and guided us and which is fundamental to our thinking. It is electromagnetism (EM) in all its many forms that has been so basic, that haunts us and guides us. EM in its many guises is where we first look, and continue to look, to deal with the quantum physics of matter, in our case semiconductors, and to invent a transistor and transistor electronics—not only integrated circuits (ICs) and power devices but also light-emitting diodes (LEDs) and lasers, and now even a transistor laser.

When I look back at how I have learned EM, I see a sort of hit and miss process with constant need for refreshing and patching as I have delved deeper and deeper into semiconductor materials and device study, ranging from germanium transistor problems in Bardeen's laboratory (1952–54) to silicon transistors and thyristors (Bell Labs and General Electric, 1954–63) to the optical domain of LEDs and lasers (General Electric and Urbana, 1960–2006). I regret not having had in my early life an EM textbook such as that of Professor Narayana Rao. My knowledge of EM would be deeper and my life in learning semiconductor device physics would have been smoother, easier, and I think richer. Not only has Professor Rao's book profited from the fact that he is a master teacher, it also has the benefit of coming from the hand of a deep researcher in the field of EM education. His experience and perspective show in his knowledge of EM and how he has been able to bring it all so conveniently to us, from beginner to seasoned expert. He has served all of us by assembling his considerable thought and knowledge, and making EM so clear and so conveniently available. We all need a

teacher such as Professor Rao to help us to learn, not just in the beginning but also later in our careers as we review and improve our knowledge. I congratulate Professor Rao for this Indian edition of the book, particularly for the young people entering the study of electronics, dare I say, semiconductor device physics and electronics.

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