Here is a little secret about BSIM3. You cannot find what BSIM stands for in the official BSIM3 manual, nor the official BSIM3 web site (at least as of March, 2000). The reason is simple—BSIM is a household name in the SPICE simulation community. It is so much used that it has become a standard vocabulary, in a similar way that we tend to forget laser stands for light amplification by stimulated emission of radiation. To save you from scratching your head, I state that BSIM is an acronym for Berkeley Short-Channel IGFET Model. As the full name suggests, it is a MOSFET model capable of handling modern CMOS devices with pronounced short-channel effects. But this description also begs the question exactly what short-channel effects are handled by BSIM3. Or, more generally, does the model account for various leakage currents and terminal resistances?

These questions as well as others are answered in Chapter 2, which summarizes the key components of BSIM3. Because circuit designers tend to view devices with an equivalent circuit, I also represent the BSIM3 model with various equivalent circuits, for various operating conditions. Although Chapter 2 serves as an entry for those who are eager to learn the basics of BSIM3, some modeling background is presented in Chapter 1. This introductory chapter is where the readers can find the meanings and connotations of various modeling jargons, such as charge conservation, quasi-static approximation, and so on. For those who really have no time to understand the details (and thus the beauty) of modeling, I have prepared Chapter 3. It contains an alphabetical listing of the BSIM3 parameters, as well as their meanings and relevant equations.

No model is perfect. BSIM3 certainly shares many of the problems that haunt other models. In Chapter 4 several areas of improvement for the BSIM3 model are pointed out, whether it is used in a dc, ac, transient, or noise analysis. Most of these improvements have been made in BSIM4, the to-date newest member of the BSIM
family introduced in 2000. The improvements of the BSIM4 are described in Chapter 5.

Many people cry foul when I praise BSIM3. They contend that it is just a biased opinion. Well, the time has come for me to clarify one point. Although I have used BSIM3 quite often and personally liked BSIM3, I am not one of the BSIM3 authors. The misconception can arise because the chief researcher in charge of the BSIM3 (and BSIM4) development happens to have the same first name initial (W.) and the same last name (Liu) as mine. This coincidence is evident particularly when the BSIM3 manual is referenced. See, for example, Ref. [14] of Chapter 1. I surely did not write any portion of the BSIM3 manual, although the reference seemingly suggests so. I merely write this book to complement the manual. Our last name, incidentally, is the royal last name of the most powerful Chinese dynasty. The Han dynasty, which existed some 2000 years before the Republic of China, is credited for the naming of the Chinese people as the Han race. And for those who aspire to be a millionaire (such as in the popular television show), here are some trivia for you—paper was invented in Han dynasty by a chamberlain/eunuch serving Emperor Liu, and the newly elected president of Republic of China is a National Taiwan University graduate named Shui-bian Chen.

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