Everyone Wants Better Models. But Where’s the ROI?

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As engineers, we don’t tend to think of the business and financial side of things first. We are looking for good technical solutions and the best way to solve a problem. In the area of RF and microwave circuit design it has become clear that simulation-based design is the way to go. This mindset has been firmly established by the availability of advanced electronic design automation (EDA) tools from companies such as Keysight, National Instruments, Cadence, and ANSYS, among others.

However, no matter how good these simulation packages are, whether or not “what you see” in your design simulation will be “what you get” on the test bench depends heavily on the accuracy and appropriateness of the device and component models. This is clearly a case of “garbage in” produces “garbage out.” Better models are the technical solution to the problem, but justifying the cost of obtaining better models needs to be addressed. Managers asked by engineers about funding for improved models typically respond with something like “where’s the ROI?” This question is not a new one as a 1996 article by Mike Golio points out.

Process Design Kits

In the area of microwave IC design, process design kits (PDKs), including needed active and passive device models, are now provided by all the major foundries. In many cases, but not all, these models have sufficient accuracy to support the “first pass design success” goal that has been the mantra for monolithic microwave integrated circuit (MMIC) design since at least the days of DARPA’s MIMIC Program that began in the late 80’s and continued into the 90’s. The government at that time made a huge investment in not only helping foundries develop, advance and demonstrate repeatable GaAs-based MMIC processes; they also funded EDA companies and modeling activities to support the goal of first-pass design success. There is no doubt that the early DARPA and corporate investments to advance EDA models for MMIC design has led to a strong return for our entire industry.

However, continued investments are needed in new and better models for MMIC and RFIC design. Foundries, and sometimes design groups, continually have to invest in new models for new and/or evolved processes and models addressing increasingly complex end-use applications. Today, this ongoing model development is accomplished by funding provided to a combination of “in-house” and independent modeling teams.

In the area of hybrid microwave integrated circuits and PCB-based designs, consisting of etched or printed circuit traces combined with discrete
devices, there has historically been less motivation for investment in accurate models to enable first-pass design success, for a couple of reasons. First, wafer fab costs can run $90K or more for each “spin” if designs fail, whereas typical PCB board and assembly rework costs are an order of magnitude less. Also, hybrid/PCB designs are amenable to post-fabrication bench tuning and many designers are resigned to using approximate models for discretes, such as transistors, diodes and RLC devices, and rely on tuning and a second or third board spin to get to the final design. The problem with this flow is that it ends up being much more costly than it first appears, in terms of schedule (time to market), cost, and sub-optimal productivity of high skilled RF and microwave design engineers.

Accurate Models

Since its founding in 2001, Modelithics has had as its mission to provide exceptionally accurate RF & microwave models that accelerate high frequency design. The Modelithics COMPLETE Library software includes a very wide range of highly scalable and accurate models for active and passive discrete devices, and effectively enables first-pass design success for the hybrid/PCB board designer. Modelithics also provides custom modeling for proprietary and commercially available MMIC/RFIC devices, in addition to discrete devices. However, whether you do a purchase or limited term license of our library models or contract custom services, or develop improved models at your own company, there is an investment required.

Modelithics has a free ROI calculator web tool to help engineers and managers run scenarios to assess the ROI of internal or outsourced investments in improved models that can reduce design spins (whether board or IC wafer based) by one or more iterations. Fig. 1 (see page 60) shows an example of typical cost savings on a microwave circuit design project scenario. In this scenario it is assumed that a $5,000 investment in improved models will avoid the need to rework a PCB-based design and reduce time required to iteratively bench test and tune the design. The return on this investment would be realized, in this case, in the first project design. The estimated savings of course depend on assumptions made, which can be customized in the calculator.

You can check out the calculator at http://roi.modelithics.com/. We’d be happy to work with you to generate an

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ROI analysis for your typical circuit design applications. Better models may just be the solution you have been looking for to shorten schedules, reduce prototype cost, and improve the productivity of your product designs.

About the Author
Dr. Larry Dunleavy co-founded Modelithics, Inc. in 2001 to provide improved modeling solutions and high-quality microwave measurement services for radio and microwave frequency circuit designers.

He is currently serving as President and CEO at Modelithics.

He also maintains a position as a Professor within University of South Florida’s Department of Electrical Engineering, where he has been a faculty member since 1990. In this role, he has been teaching in the area of RF & Microwave circuits and measurements for over 26 years. Prior to this he worked as a microwave circuit/MMIC design engineer at Hughes Aircraft and E-Systems.

Notes
2. See https://www.microwaves101.com/encyclopedias/mimic-program.

Figure 1 • Example of ROI analysis for an example hybrid/PCB circuit design project scenario illustrating cost and schedule savings projected for a $5K model investment.