

Failure Analysis and Prevention in Electronic Circuits (Design Troubleshooting for the Lab and Field) by Douglas C. Smith

for Digital and Analog Designers, Manufacturing and Field Service Engineers

“Reproducing a problem at will and displaying it on an instrument is 95% of fixing it.”

About the Course

The course covers techniques for troubleshooting design problems both in the laboratory and in field installations. Mr. Smith developed these techniques over the course of more than 30 years. Although very effective, most of the techniques are not published and are unknown to others, even experienced engineers. Most of the procedures taught have solved major design problems in a few days or sooner that were unsolved by a team of engineers, in some cases over a period of months. Some of the techniques presented are very effective at reproducing problems that occur in the field infrequently, for instance in one customer in a thousand or only a few times per year, but that can have serious consequences.

This seminar describes each technique in depth, how to apply it, and how to interpret results. A list of recommended equipment for troubleshooting difficult problems is presented. The techniques presented often use this equipment in unusual ways that are not obvious until seen.

Emphasis is placed on delivering practical knowledge that can be used immediately on the job. Some class time is reserved to discuss problems and interests of those attending. Each seminar delivery is modified to fit the interests of the attending students.

www.emcesd.com - Doug Smith's High Frequency Measurements website, which contains a wealth of interesting technical information on related topics.

Instructional Methods

The course includes a combination of teaching methods including lecture, live experiments, live computer simulations, and still pictures of experiments with results. The combination of methods combined with Mr. Smith's enthusiastic presentation style helps the students learn and enjoy the course.

Who is it for?

All circuit designers, design supervisors, manufacturing test engineers, quality engineers, and field support engineers.

Prerequisites

A college-level course on circuit analysis is desirable although the seminar will be useful to those with two-year technical degrees. Desirable, although not required, is the two day course by Mr. Smith, “High Frequency Measurements and Noise in Electronic Circuits” either before or after taking this course.

“It is of the utmost importance to change or test only one thing at a time.”

Benefits

- Learn techniques for tracking down difficult design or equipment problems in the lab or field.
- Learn to reproduce in the lab difficult field problems that happen intermittently.
- Develop an understanding for the kinds of design issues and noise sources that cause designs to fail.
- Learn how to locate and deal with the sources of noise that cause problems in designs.
- Learn about noise related reliability problems in system, board, and device design
- Learn to apply troubleshooting techniques in a logical way to uncover design problems.
- Learn construction techniques for useful laboratory apparatus that can easily track down problems.
- Learn how to use test equipment you already have in novel ways to find design problems.

Course Presenter

[Douglas Smith](#), Author of *High Frequency Measurements and Noise in Electronic Circuits*

Course Content

Technical Background

- Capacitively coupled noise currents
- Inductively coupled noise voltages
- Coupling to/from small loops and tracing noise currents through circuits and systems
- Skin Effect
- Electrical Fast Transients and how to use them for troubleshooting a wide range of problems
- di/dt and dv/dt effects in circuits
- Null experiments to verify results

Tools Discussed

- Commercially available equipment
- Simple lab built structures useful for troubleshooting
- Sources of equipment and supplies for troubleshooting

Stressing Devices, Circuits, and Systems to Elicit Failure Modes

- Methods of injecting localized, controlled amounts of noise
- Use of magnetic loops and current probes in novel ways
- Logical approach to avoid “wild goose chases”
- Useful home built apparatus
- Unconventional uses for conventional test apparatus
- Stressing designs with both impulses and continuous signals

Measurements to locate problems

- IC package noise
- Interpreting scope waveforms to determine the characteristics of environmental noise sources
- Techniques to locate an environmental noise source

Recommended equipment and sources

- Probes
- Test equipment
- List of sources

“This single day course can be the best insurance your company can buy against the consequences of a design problem.”