INTEGRATED
ENGINEERING SOFTWARE

CAE Software speeds up development in the design of modulators and sensors

About the company & products

Photonic Systems, Inc. (PSI) offers comprehensive microwave photonics engineering and manufacturing capabilities. With decades of collective photonics experience, PSI is a recognized leader, bringing best-in-class component and link solutions to customers in defense, communications, research and government. Their products enable a broad range of system performance, from basic transmission of RF over fiber for antenna remoting, to complex signal processing in radio astronomy or defense applications. Component products -such as low Vπ LiNbO3 modulators, high current photodetectors and high accuracy component controllers- are offered as integrated link products, operating to bandwidths beyond 40 GHz with the highest spur-free dynamic range and lowest noise figure available.

PSI performs research on a variety of fibre optics projects, many of them for the US Defense Department, which includes the development of new electro-optic modulators.

The challenge

As an engineer with PSI, Dr. Gary Betts uses ELECTRO for the electromagnetic analysis and design of electro-optic modulators. ELECTRO is the 2D/RS field simulator from INTEGRATED Engineering Software chosen by Dr. Betts to model the device and calculate the electric fields and microwave properties of the electrode within the modulator. The electric field in the modulator turns the light on and off, so it is very important to have an accurate model of the electric field produced by the electrodes.

In terms of the specific application, most modulators are used to communicate signals over a fiber-optic communication network. Dr. Betts explains that there are other applications where the modulator is used to sense voltages or electric fields; in these applications the device is called a “field sensor” or a “voltage sensor,” but it is still the same basic device.

Dr. Betts has extensive experience in the modulator field. The fibre optics field was all research up until the middle 80s. At the beginning in the 90’s, modulators were basically a research device; over time some models have been commercialized. Betts started with research while he was at the Massachusetts Institute of Technology (MIT) in the 90s, and then it was 2002 when he joined a private company bringing with him years in research.

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Hybrid Simulation Tools for Electromagnetic & Particle Trajectory Design Analysis

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Dr. Betts remembers that 20 years ago, before he had ELECTRO, he would have to do approximate solutions, build the device, measure it and see if it worked. Over time, PSI has used two different design methods: one is ELECTRO and the other involves a kind-of-homemade finite element solution. Even though the accuracy is probably similar, ELECTRO is much easier to operate and use because it's all graphical and the user can "just type in points and see what happens. The ease of use is much better than the alternative", Dr. Betts remarks.

The solution

Dr. Betts bought his first copy of ELECTRO in the mid 90's, before he joined PSI. Today, Dr. Betts is still using this software to solve, in some sense, the same problems that he used to solve back then: the details are different but the general application is the same. Dr. Betts comments, "I think I bought it three or four times over the years, and one of those packages had become my personal copy".

With ELECTRO, Dr. Betts has extensive experience and confidence; the software does everything he needs well so there was never a need for him to look at any other software package. As PSI has gotten involved in more difficult microwave problems, they bought a 3D high frequency microwave simulator which can calculate some of the same things ELECTRO does. "But what I found was", Dr. Betts explains, "that because the other software package was trying to do all of these complicated problems, it did a very poor job at calculating 2D electrical fields. For the application we have we needed to know the fields very accurately. I ended up still using ELECTRO for when I needed to know the fields of the TEM mode, and I only used the other software for parts of the problem where I needed particular types of microwave solutions such as reflections from a coaxial launcher or modal properties of the dielectric substrate, for example."

The result

"With ELECTRO I can calculate pretty accurately what is going to happen the first time I build the device: it is likely to either work exactly right or only need one re-design. ELECTRO vastly reduced the amount of money we had to spend on trial and error applications: the development cost is much less when we have good modeling software", Dr. Betts concludes.

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