Bill Martin
President and VP of Engg
E-System Design

Path Finding: NOT a one trick pony

In previous posts[1], I discussed a classical Path Finding methodology. Classical is when various design variables are arranged in different configurations while holding Process Variables (variation) constant. Examples would be: vary the RDL pitches, vary the size of balls or pillars used, vary the length/diameter of wire bonds, etc. This allows Path Finding to identify the solutions that meet requirements using a typical process. This has tremendous value for the Path Finder since this provides a structured process to evaluate the good from the inane. Classical Path Finding is shown in Figure 1 as the red dashed line (hold process variables constant while testing various design variations).

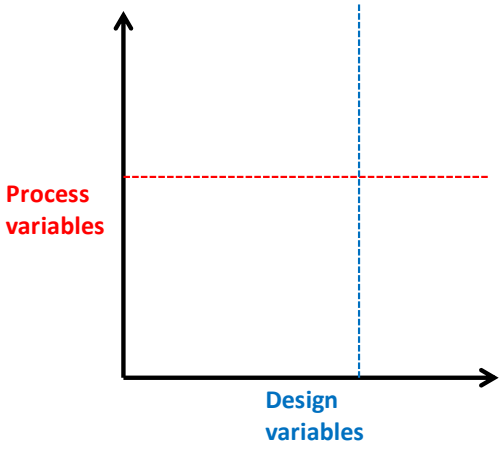

Figure 1

But what happens when we swap the variable that is constant and perform orthogonal analysis?
What type of analysis is performed and is it valuable?

By performing orthogonal Path Finding, we now 'freeze' the intended design implementation while we change the processing variables. Example processing variables would be: resistivity, permittivity, loss tan, operating temperature, metal and/or oxide thicknesses, underfill parameters, etc[2]. In Figure 1, this is represented as the blue dashed line. Now we setup up similar test cases by varying these process parameters and run new analysis.

By performing orthogonal analysis, we are now determining how ROBUST our design is for the given manufacturing process(es). This will indicate whether our design is centered in the process or if our design is sensitive to various process variables. The more sensitive a design is will cause more yield variation and therefore increase the cost to produce[3]. So the orthogonal 'classical' Path Finding is called **Robust Design** analysis.

Is Robust Design analysis valuable? Any person that is responsible for maintaining/lowering product costs OR supplying finished product to a customer understands how important a Robust Design is. Designs that are 'robust' provide consistency over the product's manufacturing lifetime. Designs that are not robust have yield inconsistencies that cause:

1. difficult planning
2. more material to be started to ensure delivery
3. higher waste and cost
4. delays in shipping required quantities to customer
5. additional resources (material, equipment and people) that could be producing other products

It is not a question of 'if' the above will happen but rather 'when' it will happen and given Murphy's Law, it will happen at the most inopportune time.

From the above, it should be obvious that **Robust Design** if not only critical and extremely valuable during the manufacturing phase: the phase that creates the products can generate revenue when products are shipped.

Notes:

1 Either on 3DIncites (www.3DIncites.com) or ChipDesign (http://eecatalog.com/chipdesign/2014/11/10/path-finding-v1-0-vs-v2-0/)

2 Many may ask: How do I choose the various process parameters? All processes (IC, Interposer, Package or PCB) will have defined processing and a range for each parameter. This might be +/- 10% or the classical: min, typ and max. This defines the process variation that is acceptable by your manufacturer. Any material outside these specifications should be scrapped for non-conformance.

3 Bill Martin article "Path Finding: Who performs and When?" has a brief section discussing yields and impact on cost. GSA Forum June 2013 Issue