



Goldmund White Paper

## THE PROTEUS TECHNOLOGY BY GOLDMUND

Since the beginning of the 20<sup>th</sup> century, Speakers have been designed by assembling an enclosure, some drivers and a crossover.

For most manufacturers, even if we are now in 21<sup>st</sup> century and computer technologies have been widely available, it remains a manual process where the design of the bass loading of the enclosure, the selection of the drivers and the schematics of the needed crossover are mostly based on the designer's experience.

In the best cases, measurements with a microphone and a recorder (or a computer) are validating that the frequency response remains in the acceptable tolerance on an as-wide-as-possible bandwidth and corrections may be applied accordingly.

In most cases, however, the frequency response is only adjusted by listening, adding errors of appreciation, which is unavoidable even for the best designers.

As for the phase response and its consequence, the linearity of the group delay with frequency, it is practically impossible to correct it in an analogue crossover design, and it usually remains ignored by a vast majority of designers.

So the best speaker designers are very much remaining artists of their specialty and completely ignore that today a scientific approach is possible and that crossovers can be made perfect if properly designed in the digital domain.

And crossover is not the only difficulty. Various diffractions created by the shape of the enclosure, resonance created by its construction etc... remain un-corrected in common designs.

It means that, even for the most talented manufacturers, creating a new speaker is a long and painful process, usually taking long months to be patiently refined.

Today, however, the solution to solve the complete design issue exists. This solution is to create a "Mathematical Model" of the finished speaker, in which all the above parameters are precisely described. Only the shape of the enclosure, its construction and the selection of the drivers are left to the designer. The resulting performance of the crossover in amplitude, phase and group delay are immediately known and corrections can be made without listening.

Such mathematical model is extremely complex and requires years of development for hyper-qualified scientists. So it remains extremely rare in the audio industry, especially among small companies.

Goldmund decided to write its own Mathematical Model in 2004 and called it Proteus. It took the company 7 years to get the first results and the Proteus model has been constantly refined since. The hardest part of the work has been to find a practical solution for correcting the group delay distortion (or Time Distortion), a problem that Goldmund has solved by the Leonardo process, now integral part of Proteus.

Today, when Goldmund creates a new speaker, the enclosure shape is designed first then the drivers are selected. But the rest of the work is mostly done by Proteus. By an iterative process, the designer can achieve the best result in a couple of hours.

This is why something like 10 pairs of new speakers have been created by Goldmund in 2014, most close to perfection, and very much sounding identical.