Mathematical models are gaining importance in our every days life. In telecommunications, they are an enabling technology for the large and simultaneous increase of data bandwidths and battery life. This demanding requirements call for a whole new class of models that describe systems and components operating under extreme conditions. Often, these techniques remain hidden for the end user, as their main role lies in the operation and the design of the portable devices.

Up to now, these mathematical representations are extracted in a dual way: either the behavior of the device is over-simplified (mathematically the model is then called linear) and the accuracy of the model is inadequate, or a full physics-based model is used (mathematically the model is then non-linear). The latter alternative results in extremely accurate models, but is often practically intractable as it comes at the cost of a very high complexity and is resource hungry.

In this thesis, we tried to combine the best of both worlds: provide models that have an acceptable level of accuracy, but remain easy to understand, to interpret and above all remain resource friendly. This new method opens the way for a whole new generation of enabling design tools for the manufacturing of tomorrows feature-rich portable telecom equipment.