Model reduction of nonlinear systems – use of multi-time scale models and model reduction techniques

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For the simulation of envelope modulated RF circuits, multi-time scale models are extremely efficient as the envelope can be simulated using a time-domain integration technique and the carrier can be simulated using harmonic balance or wavelets. Standard time-domain integration would be too time-consuming for the complex modulated signals present today in RF circuits and harmonic balance would be inefficient for highly nonlinear circuits. Multitime scale approaches can also be employed in biosystems again with a view to separating the varying time scales in the systems so as to facilitate analysis. Further efficiencies in the simulation process can be achieved if a nonlinear model reduction technique is applied in conjunction with the multi-timescale model. This is an area of interest to our research group and research is ongoing in the area. For the applications to date, significant improvements in efficiencies are achieved over standard simulation approaches.