

4.17.4. Power Amplifiers. Large-signal models for nonlinear circuit analysis

() – (Prof. Paolo Colantonio, Università degli Studi di Roma “Tor Vergata” - Dip.to Ing. Elettronica) – 2010 .
(G.Leuzzi, Dept. Electrical and Information Engineering - Univ. L’Aquila – Italy) – 2010 .

Power amplifier plays a key role in communication systems.

Overview on power generating and limiting mechanisms leading to the identification of “power match condition”. Introduction and definition of PA classification. The power budget.

Load Source Pull Design Approach.

Power balance consideration and unifying theory for high efficiency PA design criteria.

Class E PA design.

High Frequency HT Pas.

Multi-band PA design (with example).

Load/Source Pull Measurements

- Qualified personnel;
- Up-to-date computer and CAD software;
- Considerable effort for characterization (also breakdown and forward gate conduction);
- The model can be used for different non linear applications (mixers, multipliers,...) and can be scaled to different peripheries;
- Ease of accounting for harmonic loading effects;
- Simulation gives more information and control on the physical operation of the device.

CAD Tool + Nonlinear device model

Nonlinear models

- Dedicated and expensive measurement system;
- Low impedances can be generated at the expense of system complexity (active load-pull or transformers);
- Harmonic impedances are difficult to control;
- Characterisation of a 'real' device;
- Optimum network terminations are directly measured;
- Power, gain, efficiency and intermodulation contour plots.

CAD Tool

Device, circuit and system level

- Transient or steady-state
- Time or frequency domain
- Single tone, multi-tone, complex modulation schemes
- Weak or strong nonlinearities
- Layout capabilities / EM analysis
- Stability

Nonlinear device model

Application-oriented (low voltage, class-B, low distortion, etc.);

- Suitable for the selected algorithm or analysis method;
- Scalable with gate periphery;
- Physically consistent and accurate for both small- and large-signal analysis;
- Compatible with the selected CAD tool