Large-Signal Analysis Of Class A Vacuum Triode Push-Pull Output Stage

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Summary

A mathematical model for the input-output characteristic of a class A push-pull output stage using triode vacuum tube amplifiers is presented. The model, basically a sine series function, can easily yield closed-form series expressions for the amplitudes of the output components resulting from multisinusoidal input signals to the output stage. The special case of an equal-amplitude two-tone input signal is considered in detail. The results show that, similar to a transistor-based class A output stage, the vacuum triode class A output stage generates only odd-order harmonic and intermodulation components. The results also show that the amplitudes of these components are strongly dependent on the amount of cathode feedback and the amplitudes of the input tones. For sufficiently small input tone amplitudes, the relative harmonic and intermodulation products are too small and their magnitudes are within or close to the error range of the Fourier series approximation. However, for relatively large input tone amplitudes the relative harmonic and intermodulation components are increasing monotonically with the input tone amplitudes.

References:

1. 1989, INTUSOFT NEWSL  FEB, P1
2. 1994, INTUSOFT NEWSL  APR, P7
3. 1994, INTUSOFT NEWSL  FEB, P6
4. ABRAMOWITZ M, 1964, HDB MATH FUNCTIONS
5. ABUELMAATTI MT, 1993, INT J MATH ED SCI TE, V24, P107
6. ABUELMAATTI MT, 1994, IEE P-SCI MEAS TECH, V141, P177
7. ABUELMAATTI MT, 2003, J AUDIO ENG SOC, V51, P1046
8. BACHMANN R, 1972, BROWN BOVERI REV, V9, P458
10. BOYK J, 2003, SMALL SIGNAL DISTORT
11. BROYDE F, 1997, J AUDIO ENG SOC, V45, P490
13. DEHANN W, 2001, ELECTR WORLD, V107, P61
14. HICKMAN I, 1999, ELECTRON WORLD, V105, P224
15. HOOD JL, 1997, VALVE TRANSISTOR AUD
16. KREYSZIG E, 1983, ADV ENG MATH
17. LANGFORDSMITH F, 1997, RADIO DESIGNERS HDB
18. LEACH WM, 1995, J AUDIO ENG SOC, V43, P117
19. MILLMAN J, 1958, VACUUM TUBE SEMICOND, CH16
20. MOLE P, 1994, IEE P-CIRC DEV SYST, V141, P241
22. PITTMAN RA, 1988, TUBE AMP BOOK, V2
23. PRITCHARD EK, 1997, J AUDIO ENG SOC, V45, P488
24. RESHETNIKOV OM, 1984, TELECOMM RADIO ENG, V38, P121
25. REYNOLDS S, 1993, GLASS AUDIO, V5, P17
26. RYDER JD, 1967, ENG ELECT, CH6
27. SEELEY S, 1958, ELECT TUBE CIRCUITS, CH2
29. SJURSEN W, 1997, J AUDIO ENG SOC, V45, P1082
30. SPANGENBERG KR, 1957, FUNDAMENTALS ELECT D, CH15
32. TOUZELET P, 2002, J AUDIO ENG SOC, V50, P519
33. VANDERVEEN M, 1998, J AUDIO ENG SOC, V46, P583
34. VANDERVEEN M, 2003, J AUDIO ENG SOC, V51, P414
35. WONG CC, 2001, ELECTRON WORLD, V107, P789

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