WS 12.1 Simple model of a triode power amplifier

This Mathcad 14 worksheet is designed to accompany the author's book "Microwave and RF Vacuum Electronic Power Sources", Cambridge University Press (2018). The section, equation, and figure numbers refer to the corresponding sections, equations, and figures in the book. Data input fields are highlighted in yellow and output fields are highlighted in green.

This sheet illustrates the properties of a power amplifier using a simple model of a triode amplifier.

Define the anode current normalised to the peak current

$$I(\theta,\alpha) := \left| \begin{array}{l} I_a \leftarrow \left(\dfrac{\cos(\theta) - \cos(0.5\cdot\alpha)}{1 - \cos(0.5\cdot\alpha)} \right) \\ I \leftarrow \left| \begin{array}{ll} I_a^{\,1.5} & \text{if } I_a \geq 0 \\ 0 & \text{otherwise} \end{array} \right. \\ \text{return } I \end{array} \right.$$

Equation 12.6

Amplitudes of the first two harmonics of the current

$$I_0(\alpha) := \frac{1}{\pi}\cdot\int_0^{\frac{\alpha}{2}} I(\theta,\alpha)\, d\theta \qquad I_1(\alpha) := \frac{2}{\pi}\cdot\int_0^{\frac{\alpha}{2}} \cos(\theta)\cdot I(\theta,\alpha)\, d\theta$$

Efficiency as a function of conduction angle and r.f. voltage amplitude on the anode normalised to the d.c. anode potential

$$\eta(\alpha, V_{a1}) := \frac{V_{a1}\cdot I_1(\alpha)}{2\cdot I_0(\alpha)}$$

Equation 12.11

$\theta := -\pi, -0.99 \cdot \pi .. \pi$

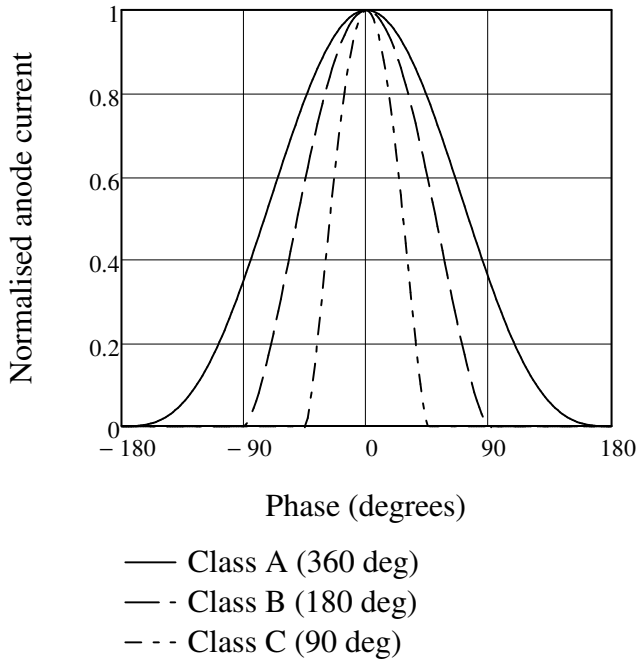
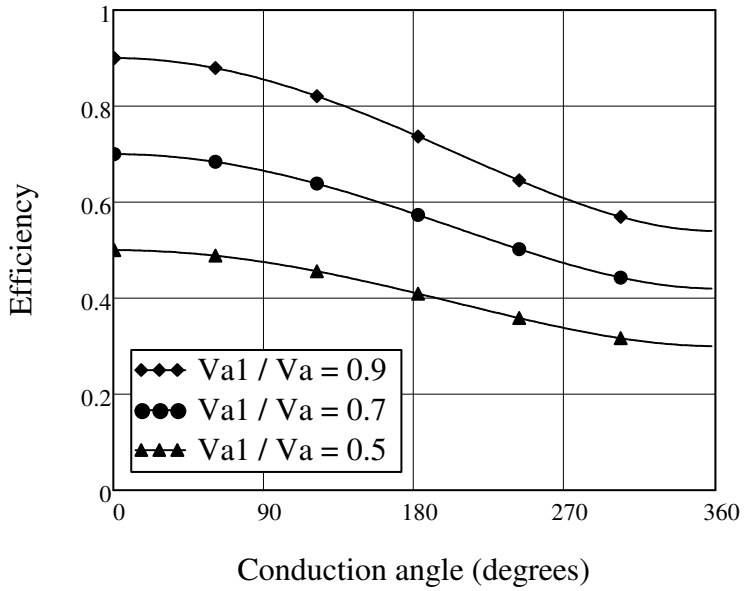


Figure 12.4

$\alpha := 0.01, 0.02 \cdot \pi .. 2 \cdot \pi$



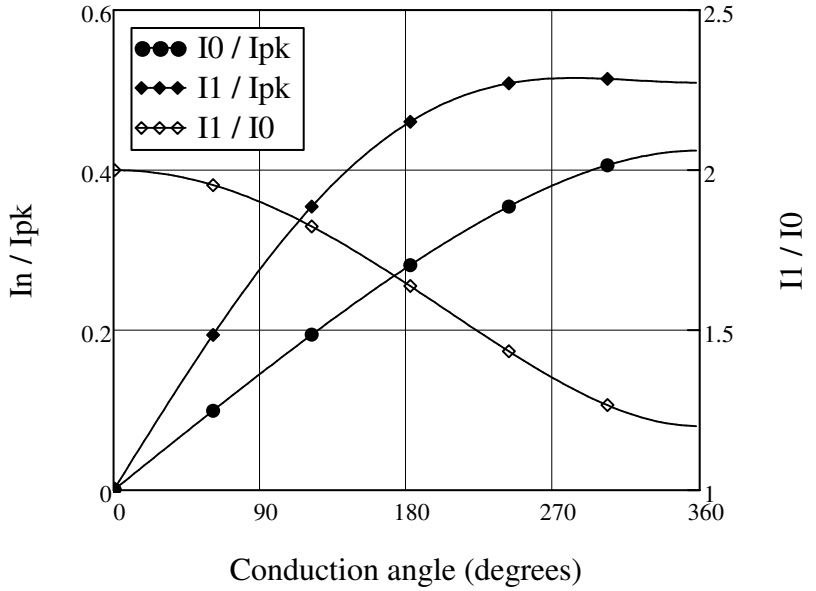


Figure 12.5