The noise, ϵ, has support $[-\bar{\epsilon}, \bar{\epsilon}]$ and is distributed according to the PDF

$$g(e;\alpha,\beta) = g(\alpha,\beta)^{-1}(e+\bar{\epsilon})^{\alpha-1}(e-\bar{\epsilon})^{\beta-1} \tag{1}$$

where

$$G(\alpha,\beta) = \int_{-\bar{\epsilon}}^{\bar{\epsilon}} (\bar{\epsilon}+e)^{\alpha-1}(\bar{\epsilon}-e)^{\beta-1} de. \tag{2}$$

g is just the PDF of the Beta distribution with support $[-\bar{\epsilon}, \bar{\epsilon}]$. Put $x = (\bar{\epsilon}+e)/2\bar{\epsilon}$ and observe that

$$\begin{aligned} G(\alpha,\beta) &= \int_0^1 (2\bar{\epsilon}x)^{\alpha-1}(\bar{\epsilon}-(2\bar{\epsilon}x-\bar{\epsilon}))^{\beta-1} 2\bar{\epsilon} dx && (3) \\ &= (2\bar{\epsilon})^{\alpha+\beta-1} \int_0^1 x^{\alpha-1}(1-x)^{\beta-1} dx && (4) \\ &= (2\bar{\epsilon})^{\alpha+\beta-1} B(\alpha,\beta) && (5) \end{aligned}$$

where B is the beta function. We require that ϵ has mean zero:

$$0 = E[\epsilon] = \int_{-\bar{\epsilon}}^{\bar{\epsilon}} e(e+\bar{\epsilon})^{\alpha}(e-\bar{\epsilon})^{\beta} de = \frac{\alpha}{\alpha+\beta}. \tag{6}$$

Hence, ϵ has variance

$$0 = E[\epsilon^2] = \int_{-\bar{\epsilon}}^{\bar{\epsilon}} e^2(e+\bar{\epsilon})^{\alpha}(e-\bar{\epsilon})^{\beta} de \tag{7}$$