



Fig. 1 Optimal clipping λ_{opt} in (7) and maximum input-output SNR gain G_{\max} at λ_{opt} against function of RMS amplitude σ_ξ (in units of $A=1$) of zero-mean Gaussian noise $\xi(t)$

The present analysis establishes that simple nonlinear devices can be used as SNR amplifiers for a harmonic signal in noise, an outcome which is inaccessible with linear devices. The present treatment is general in $g(\cdot)$ (and also in the noise density f_ξ); we have tested here the simple $g(\cdot)$ of (7), the electronic implementation of which is easy; but other nonlinearities $g(\cdot)$ can be tested for an SNR amplification $G > 1$. Power-law nonlinearities tested in [4] exhibit a similar property of $G > 1$ but with a more complex physical implementation. Additionally, application of the present treatment shows that hard-threshold nonlinearities, like signum or Heaviside functions for $g(\cdot)$, do not allow $G > 1$ with Gaussian noise. Other common nonlinearities encountered, for instance in semiconductor devices, could also be tested for SNR amplification. Such simple nonlinear operators offer a useful complement to linear techniques for signal processing and sensors.

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