Dynamic Range

Upper power limit   1-dB compression point
Output is 1 dB down from the ideal linear response

Intermod – intermodulation distortion (IMD)
Third-order distortion products of two signals. \(2f_1-f_2, 2f_2-f_1\)
Response of amplifier to third-order signals.
Intermodulation Distortion (IMD) Intermod

When two frequencies are amplified, \( f_1 \) & \( f_2 \)
Distortion
\[
vo = k_0 + K_1vi + K_2vi^2 + K_3vi^3 + K_4vi^4 + 
\]
\[
vi(t) = A_1 \sin \omega_1 t + A_2 \sin \omega_2 t
\]

2\textsuperscript{nd} order distortion products – out of passband
- \( 2f_1, 2f_2, f_1+f_2, f_1-f_2 \)

3\textsuperscript{rd} order distortion products in passband
- \( 2f_1-f_2, 2f_2-f_1 \) are in passband usually

\[
K_3vi^3 = K_3(A_1 \sin \omega_1 t + A_2 \sin \omega_2 t)^3
\]

MOSFET has lower values for the cube term.

Intermodulation products that will fall within the passband are,
\[
3/4 K_3 A_1 A_2 \sin(2 \omega_1 - \omega_2)t \quad \text{and} \quad 3/4 K_3 A_1 A_2 \sin(2 \omega_2 - \omega_1)t
\]
So both rise as power input rises, thus slope of plot of their power is greater than 1\textsuperscript{st} order term.

Input third-order intercept = 3\textsuperscript{rd} order of amp minus \textbf{added gain of a preamp}
Show how gain of preamp boosts the intermod product power plot.
approximation
\[
\text{dynamic range (dB)} = 2/3(\text{input intercept} - \text{noise floor}), \text{higher 3}\textsuperscript{rd} \text{order intercept is better.}
\]