mode of operation, the variable gain amplifier is no longer amplifying linearly, making piecewise-linear dynamics impossible. The regions of linear amplification and saturation for the variable gain amplifier can be seen in Fig. 2.2.

Proper switching of the voltage acting on the gain control port \( V_{\text{ctl}} \) thus acts to bound the amplitude of the feedback loop oscillations within the region of linear amplification, while also implementing a discrete switch, which creates the piecewise-linear amplitude modulation of the ultra-high-frequency oscillations.

In addition to the gain control port \( V_{\text{ctl}} \), the attenuation control port labeled \( V_{\text{dd1}} \) is also a method for adjusting the gain through the variable gain amplifier. The attenuation control port \( V_{\text{dd1}} \) sets the maximum gain and is fed a fixed valued voltage between 0 and 5 V, where higher voltage leads to higher maximum gain. In contrast, the gain control port \( V_{\text{ctl}} \) serves as the dynamical gain control of the variable gain amplifier and switches the gain between gain greater than one and gain less than one depending on the signal of the control loop. Higher control loop voltages applied to the \( V_{\text{ctl}} \) port lead to decreased gain. The gain through the variable gain amplifier as a function of \( V_{\text{dd1}} \) with fixed \( V_{\text{ctl}} \) is shown in Fig. 4.1a and the gain as a function of \( V_{\text{ctl}} \) for fixed \( V_{\text{dd1}} \) is shown in Fig. 4.1b.