Encapsulated microbubbles (EMBs) are widely used to enhance contrast in ultrasound sonography and are emerging as powerful tools for noninvasive therapies ranging from drug and gene delivery to tumor destruction. To use EMBs effectively in biomedical applications and reduce unwanted side effects, the spherical and nonspherical oscillations of microbubbles must be controlled. This talk discusses the use of different control schemes to optimize the acoustic driving for a specific objective, such as controlling the bubble size and frequency, or exciting shape modes to incite bubble rupture. The nonlinear control methodologies of sliding mode control and optimal control are used. In the latter case, various cost functions can be prescribed that enhance the dynamic response while minimizing overall acoustic energy input to improve patient safety.