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Simulation of the ultrasound-induced growth and collapse of a near-wall bubble[1] BRADLEY BOYD, SID BECKER, Univ of Canterbury — In this study, we consider the acoustically driven growth and collapse of a cavitation bubble in a fluid medium exposed to an ultrasound field. The bubble dynamics are modelled using a compressible, inviscid, multiphase model. The numerical scheme consists of a conservative interface capturing scheme which uses the fifth-order WENO reconstruction with a maximum-principle-satisfying and positivity-preserving limiter, and the HLLC approximate Riemann flux. To model the ultrasound input, a moving boundary oscillates through a fixed grid of finite-volume cells. The growth phase of the simulation shows the rapid non-spherical growth of the near-wall bubble. Once the bubble reaches its maximum size and the collapse phase begins, the simulation shows the formation of a jet which penetrates the bubble towards the wall at the later stages of the collapse. For a bubble with an initial radius of 50 μm and an ultrasound pressure amplitude of 200 kPa, the pressure experienced by the wall increased rapidly nearing the end of the collapse, reaching a peak pressure of 13 MPa. This model is an important development in the field as it represents the physics of acoustic cavitation in more detail than before.

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