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Subharmonic response from ultrasound contrast microbubbles for noninvasive blood pressure estimation AMIT KATIYAR, KAUSIK SARKAR, University of Delaware, FLEMMING FORSBERG, Thomas Jefferson University — Estimation of local organ-level blood pressure can help in diagnosing and monitoring heart and vascular diseases. Subharmonic signals from ultrasound contrast microbubbles have been proposed as a noninvasive alternative to the current practice of using manometer-tipped catheter. Approximately 10dB linear decrease in subharmonic component with 25 kPa pressure increase (typical blood pressure variation) has been reported for several contrast microbubbles. Here we report a theoretical investigation of the underlying phenomenon. We first study the well established model of a free microbubble to show that reduction of subharmonic with ambient pressure increase occurs only below a certain excitation frequency. Above this critical frequency, subharmonic signal increases with ambient pressure. Furthermore, where it decreases with ambient pressure, the relationship is linear only above certain excitation pressure. The dependence of the critical frequency on bubble radius and possibly bubble size distribution is discussed. We also report similar behavior for several models for encapsulated contrast microbubbles.

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