

LETTERS TO THE EDITOR

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Comment on “Time domain Doppler estimators of the amplitude of vibrating targets” [J. Acoust. Soc. Am. 91, 965–974 (1992)]

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(Received 3 April 1992; accepted for publication 25 September 1992)

It is pointed out that the subject paper is valid only in an extremely limited regime, due to the influences of medium nonlinearities.

PACS numbers: 43.25.Cb, 43.60.Gk, 43.80.Vj

We have previously pointed out^{1–3} that using linear Doppler effect analysis to evaluate scattering by a vibrating surface produces inaccurate results in acoustics, except under highly specialized conditions.⁴ Our objections are based on the fact that medium nonlinearities, and nonlinearities in the fundamental acoustical equations, produce much stronger effects than those predicted on the basis of linear acoustical theory. In the subject paper,⁵ it is suggested that our objections do not apply to the case considered because, “...for the simplified case of a sinusoidally vibrating target, the returned signal can be represented by a pure-tone frequency modulation (FM) process.” (See the last sentence beginning on p. 965 of Ref. 5.) However, the cases we have studied^{1–4} have, in fact, involved sinusoidally vibrating surfaces. (For example, the simple case of the scattering of a normally incident sinusoidal plane wave from a sinusoidally vibrating planar surface was considered in Ref. 3.) Thus, our objections do, in fact, apply to Ref. 5.

An earlier paper by the same authors⁶ correctly restricts the method of linear Doppler effect analysis to cases in which the wavelength of the scattered waves is much larger

than the geometrical dimensions of the scatterer, a condition which was described earlier by us.⁴ Thus we have no objections to Ref. 6. However, it should not be thought that the results of Ref. 5 are less restricted because of the simple sinusoidal surface vibrations that are considered. The results of Ref. 5 must be restricted in the same way, and for the same reasons, as those of Ref. 6.

¹J. C. Piquette and A. L. Van Buren, “Nonlinear scattering of acoustic waves by vibrating surfaces,” *J. Acoust. Soc. Am.* **76**, 880–889 (1984).

²J. C. Piquette and A. L. Van Buren, “Comments on ‘Harmonic and transient scattering by time varying obstacles [J. Acoust. Soc. Am. **76**, 1527–1534 (1984)],” *J. Acoust. Soc. Am.* **79**, 179–180 (1986).

³J. C. Piquette and A. L. Van Buren, “Some further remarks regarding scattering of an acoustic wave by a vibrating surface,” *J. Acoust. Soc. Am.* **80**, 1533–1536 (1986).

⁴J. C. Piquette, A. L. Van Buren, and P. H. Rogers, “Censor’s acoustical Doppler effect analysis—Is it a valid method?,” *J. Acoust. Soc. Am.* **83**, 1681–1682 (1988).

⁵S. Huang, R. M. Lerner, and K. J. Parker, “Time domain Doppler estimators of the amplitude of vibrating targets,” *J. Acoust. Soc. Am.* **91**, 965–974 (1992).

⁶S. Huang, R. M. Lerner, and K. J. Parker, “On estimating the amplitude of harmonic vibration from the Doppler spectrum of reflected signals,” *J. Acoust. Soc. Am.* **88**, 2702–2712 (1990).