Accepted Manuscript

Acoustic radiation force on a rigid cylinder in an off-axis Gaussian beam near an impedance boundary

Yupei Qiao, Jingyao Shi, Xiaofeng Zhang, Guangbin Zhang

PII: S0165-2125(18)30151-3
DOI: https://doi.org/10.1016/j.wavemoti.2018.09.004
Reference: WAMOT 2278

To appear in: *Wave Motion*

Received date : 14 April 2018
Revised date : 18 July 2018
Accepted date : 7 September 2018

Please cite this article as: Y. Qiao, et al., Acoustic radiation force on a rigid cylinder in an off-axis Gaussian beam near an impedance boundary, *Wave Motion* (2018), https://doi.org/10.1016/j.wavemoti.2018.09.004

Acoustic radiation force on a rigid cylinder in an off-axis Gaussian beam near an impedance boundary

Yupei Qiao, Jingyao Shi, Xiaofeng Zhang*, Guangbin Zhang

School of Physics and Information Technology, Shaanxi Normal University, Shaanxi Key Laboratory of Ultrasonics, Xi'an 710119, China

Abstract: The exact equations of the axial and transverse acoustic radiation force functions of a Gaussian beam arbitrarily incident on an infinite rigid cylinder close to an impedance boundary and immersed in an ideal fluid are deduced by expressing the incident wave, the scattering wave and the boundary reflected wave in terms of the cylindrical wave function. The effects of the beam waist, the sound reflection coefficient, the cylinder position and the distance from the impedance boundary on the acoustic radiation force are studied using numerical simulations. The simulation results show that the amplitude of the acoustic radiation force function increases with beam width. Moreover, the values of the acoustic radiation force in both the axial and transverse directions reach those of a plane wave when the beam width is considerably larger than the wavelength of the Gaussian beam. The properties of the impedance boundary and the position of the cylinder in the Gaussian beam have a considerable effect on the magnitude and direction of the force. The simulation results, particularly in the case of a transverse force, indicate the presence of a negative acoustic radiation force that is related to the nondimensional frequency and position of the cylinder in the Gaussian beam.

Keywords: acoustic radiation force; impedance boundary; rigid infinitely cylinder; off-axis Gaussian beam

* Corresponding author.
E-mail address: xiaofengzhang71@snnu.edu.cn (X. Zhang).