

Tubular ultrasonic transducer: MUST with radial excitation versus conventional axial excitation – SMART 2019

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Abstract

The ultrasonic transducer are usually used for converting electrical energy to the mechanical vibration. The mechanical energy is transmitted to a media in order to impact its properties. The energy conversion is obtained using the Langevin ultrasonic transducer which is typically made up of rear mass, head mass (emitter) and active material (piezoelectric material) as depicted in Figure 1. The head mass is the part to be in contact with the media to be treated. In order to increase the emitting surface, the ultrasonic converter is connected to a resonator with different shapes. The tubular solutions (Figure 2) are widespread for applications requiring cavitation generation like sonochemistry, ultrasonic cleaning, surface treatment... The tubular ultrasonic transducers are made up of a tube and the Langevin ultrasonic transducer. In this way, the tube is axially excited in order to have a radial vibration on the tube. These tubular ultrasonic transducers are limited by the length of the tube. Indeed, the acoustic emitted energy from the resonator decreases at the end of tube (the opposite side to the converter location). In order to increase the length of the resonator, another approach is proposed. The solution is based on radial excitation of the tube instead of axial (Figure 3). The ultrasonic converter is installed inside the tube. In such way, the mechanical vibration is better distributed in both side of the ultrasonic converter (Figure 4). Additionally, several tubes are mechanically connected in order to increase the length (emitting surface).

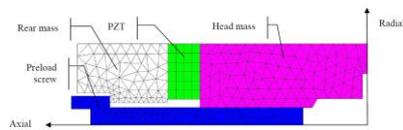


Figure 1 : Ultrasonic converter

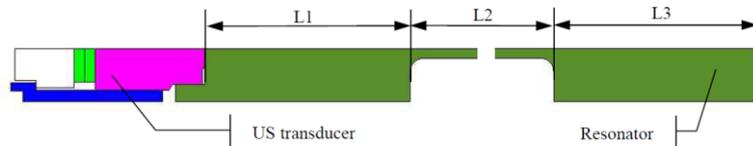


Figure 2 : Tubular ultrasonic transducer with axial excitation

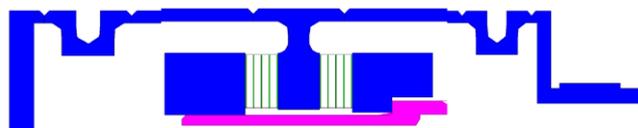


Figure 3 : Tubular ultrasonic transducer with radial excitation

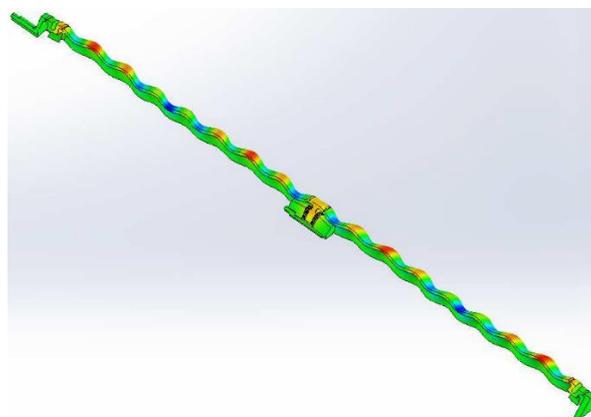


Figure 4 : Mechanical vibration distribution