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# Using Fourier analysis of the resonance frequency in glassware to identify defects

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Quality control is a vital aspect in any industry. In glass manufacturing industry, manual inspections, using human vision is the most commonly and widely used quality inspection and verification methods. With increased demand for glassware, production had increased with the support from industrial machineries. However, due to the limited number of experts' availability, manual inspection is becoming the bottleneck for the process. In addition, slow processing speed, human error, fatigue and increased labor costs suggest automation of such a process can improve within glass industry. This study aiming to identify the possibility of defects of glassware using acoustic resonance. It is expected to be cheaper and faster than compare to techniques such as computer vision or human inspections. First, the glassware is exposed to a small impact to make it vibrate. At present, this is done by allowing a tiny iron ball to hit the glassware. This impact is small enough to be nondestructive. Once the glass starts to vibrate, it will resonate at the natural frequency. Our initial results suggest, that this is not a single frequency but a composition of many frequencies. This frequency responses depend on several factors including shape, weight and continuity of the glassware surface. The Fourier transformation has been utilized to decompose the frequency responses. This signature is then compared with a frequency signature captured from a glassware, produced under desired specification, i.e. benchmark. Our initial results show glasses with common defects have a different signature than the glasses, which passed the quality test. As future works, we aim to identify the type and the severity of the defect via the frequency signature.

**Keywords:** Acoustic resonance, Fourier analysis, glass defects, nondestructive testing