

Autofocused three-dimensional ultrasonic imaging system for non-destructive evaluation (NDE) of materials and components

CSIC has developed a system for ultrasound non-destructive evaluation (NDE) of materials and components, capable of obtaining, in real time, three-dimensional auto-focused images even in the presence of interfaces between different media of complex geometry.

It allows to significantly improve the quality, flexibility and productivity of current automatic immersion ultrasonic inspection systems. The use of matrix arrays together with robust autofocus algorithms and ultra-fast image composition represent a new paradigm in automatic ultrasonic inspection systems.

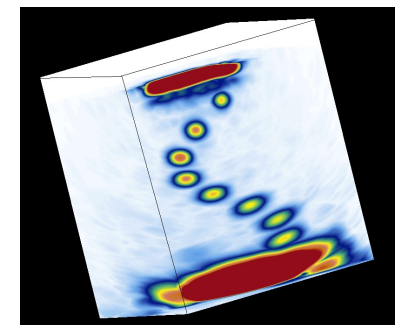
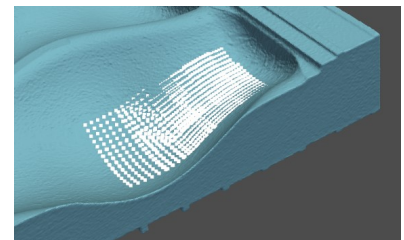
Industrial partners are being sought to collaborate through a patent licence agreement.

An offer for Patent Licensing

Auto-focused three-dimensional ultrasonic imaging

The main limitations of current automatic ultrasound inspection systems by water immersion, are the need to accurately know the geometry of the component, to define a well-controlled trajectory and to pre-calculate the focusing delays for every array element and pixel in the image. This inspection planning process is complex and costly, and must be repeated for each new component to be inspected. If, in addition, linear probes are used, the alignment of the inspection head with the piece is critical, giving rise to very inflexible systems.

The present invention overcomes these limitations by using matrix arrays, capable of directing the ultrasonic beam in any direction, along with an innovative algorithm for automatic surface detection, focal law calculation, and real-time image generation. This allows minimizing the inspection planning work, while obtaining systems that are tolerant with component misalignment and/or geometry changes, in real time and at high inspection speeds.



Above: automatic detection of a surface
Below: focused volumetric image

Main innovations and advantages

- **Autofocus:** the system automatically obtains the best possible image in every position, detecting the surface in each acquisition and adjusting the focal laws on-the-fly in real time.
- **Three-dimensional focusing:** matrix arrays allow the ultrasonic beam to be focused in any direction, simplifying the definition of trajectories and the mechanics of the inspection head.
- **Real time:** it operates in strict real time, with linear inspection speeds of up to 500 mm/s, depending on the size of the image to be generated.
- **Ideal for the inspection of small and medium-sized components with complex geometry,** which are currently inspected manually and without registration.

Patent Status

Priority patent application filed suitable for international extension

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