Automatic ultrasonic surface reconstruction in the context of robotized inspection of complex geometry components

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It is well-known that the performances of an ultrasonic inspection may be degraded when the component to be inspected exhibits an uneven surface (grinding wave, weld bead). Extensive works have been already carried out at CEA List in order to propose adaptive array techniques to deal with surface variations. In the case of inspection in immersion, the techniques relies on the reconstruction of the surface geometry by extracting profiles from ultrasonic images and in particular TFM (Total Focusing Method) images. From the knowledge of this surface and the definition of the inspection robotic trajectory, adapted focal laws can then be computed or imaging algorithms (such as TFM) can be applied in order to correct the effect of the surface at every location of the array. Due to the mechanical vibrations high-speed robotic arms, it may happen that the probe position coordinates provided by the robotic system are not precise enough to ensure an accurate reconstruction (stitching) of a composite image from all individual images. To handle this effect we propose a stitching method specifically designed to create a single image of the surface of an inspected component from a stack of TFM (Total Focusing Method) images. In this communication we will report these recent developments.