Advanced Ultrasonic Blade Root Examination

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Abstract
Blade roots are of the most stressed areas of an in service turbine rotor. The steam operating conditions of High pressure, high temperature, physical and chemical conditions mixed with microscopic surface irregularities promotes corrosion and crack propagation. The mechanical environment for the in-service examination of these components does not generally allow for high level of probability of detection, repeatability, reliability by employing manual inspection processes. This paper describes an advanced automated tool and process of blade root examination. Blade roots have complex geometries often coupled with contoured profiles. Available access is mostly restricted to aerofoil. Through a device adaptive to the profile of the aerofoil each ultrasonic shot is steered according to the element location and directed to the corresponding specified targets. It is an auto-adaptative process that accelerates the time required for locating and placement of the elements. The application uses a mechanical package that follows the blade aerofoil profile, an advanced sensor and a multiplexed or parallel multichannel ultrasonic unit steered by software. The study, design and set up of the full scanner package will be presented. The results predicted though numerical modeling as and the actual practical results are compared. The auto adaptive scanning technology applied to blade root examination coupled with the capacity to model meets the stringent demands of a reliable maintenance engineering tool. The application of this technology enables the prediction of results, the in situ examination without total dismantling of components, a high level of probability of detection, repeatability, reliability, and the presentation of valuable results that can easily be meaningfully interpreted by maintenance engineering personnel who need not be skilled in the analysis of Ultrasonic data.

Keywords: Turbine blade roots, in-service inspection, ultrasonic, auto-adaptative, maintenance