

Solid-State Excitation Laser for Laser-Ultrasonics

U. Schnars^{*}, W. Platz^{**}, P. Mahnke^{***}, A. Fix^{****}, M. Frede^{*****}, J. Neumann^{*****}, and P. Peuser^{**}

^{*} Airbus, Airbus-Allee 1, D-28199 Bremen, Germany

^{**} EADS Innovation Works, Willy-Messerschmitt-Str. 1, D-81663 Muenchen, Germany

^{***}DLR Institut für Technische Physik, Pfaffenwaldring 38, D-70569 Stuttgart

^{****}DLR Institut für Physik der Atmosphäre, Postfach 1116, D-82230 Wessling

^{*****}Laser Zentrum Hannover, Hollerithallee 8, D-30419 Hannover

The inspection speed of laser-ultrasonics compared with conventional ultrasonic testing is limited by the pulse repetition rate of the excitation laser. The maximum pulse repetition rate reported up to now for CO₂-lasers, which are presently used for nearly all systems, is in the range of 400 Hz. In this paper a new approach based on a diode-pumped solid-state laser is discussed, which is currently being developed. This new excitation laser is designed for a repetition rate of 1 kHz and will operate at a mid-IR wavelength of 3.3 μm. The higher repetition rate enables a higher inspection speed, whereas the mid-IR wavelength anticipates a better coupling efficiency. The total power for pumping the laser crystals is transported via flexible optical fibres to the compact laser head, thus allowing operation on a robot arm. The laser head consists of a master oscillator feeding several lines of power amplifiers and includes nonlinear optical wavelength conversion by an optical parametric process. It is characterized by a modular construction which provides optimal conditions for operation at high average power as well as for easy maintenance. These features will enable building reliable, long-lived, rugged, smart laser ultrasonic systems in future. First results will be presented.