Elastic Wave Fields Generated by Shear Horizontal Piezoelectric Fiber Patch (SH-PFP) Transducers: Parameter Study by Modelling and Laser Vibrometric Measurements

Bernd Köhler, Tobias Gaul, Frank Schubert, and Uwe Lieske, Fraunhofer Institute of Ceramic Materials and Systems, Maria-Reiche Str. 2, 01109 Dresden, Germany

Recently, a novel lightweight and thin piezoelectric transducer was proposed [1-3]. It generates in-plane surface tractions and thus shear horizontal elastic waves in both bulk materials and waveguides. The paper describes the principle of operation of this Shear Horizontal Piezoelectric Fiber Patch (SH-PFP). In continuation of the previous work, several variants of the SH-PFP are studied. The generated wavefield is characterized by wavefield snapshots and directivity functions. Both numerical simulation and measurements by 3D Laser Vibrometry are performed and the results are compared, showing a good agreement. We discuss possible further developments of the SH-PFP transducer to allow 1D directivity and we also discuss various possible sensor applications.

Figure 1. Snapshot of the wave emitted by a SH-PFP in a plate (material steel; dimensions 1000 x 1000 x 2 mm³). Left: simulation using an EFIT code; Right: measurement by 3D laser vibrometry. The values in the black area are influenced strongly by noise because the optical conditions are bad at the sensor and the electrical cables. They are set to zero. In both snapshots the surface velocity in x (horizontal)-direction is plotted.

References: