

## Part IV

# Continuous Mode Conversion

**Abstract** When Lamb-waves are generated in a material point of an isotropic plate structure, the fronts of the  $S_0$ - and  $A_0$ -waves propagate circularly due to the non-directional material properties. In the case of anisotropic material behavior, however, the material properties as well as the phase and group velocities become directional. Considering carbon fiber reinforced plastics, one not only has to account for anisotropy but also for the fact that the material consists of at least two constituents. Therefore, the material is inhomogeneous as it can easily be observed at the microscale. Moreover, besides unidirectional layers woven fabrics may be included in carbon fiber reinforced plastics and complicate the lay-up.

The current part of the book at hand deals with the implications of carbon fiber reinforced plastics material behavior for the propagation of guided waves. It starts with the presentation of experimental observations in which the nature of wave propagation in composite plates is investigated systematically. It is shown that the fundamental symmetric mode not only converts into the antisymmetric one at defects but also continuously in the course of propagation. The reasons of this phenomenon, which is called continuous mode conversion, are investigated in the next chapter experimentally.

The experimental findings have been accounted for in numerical models which are used for wave propagation analysis. Conventional models of carbon fiber reinforced plastics are not adequate so that enhanced material models were developed which are able to represent continuous mode conversion. So, the second chapter of this part investigates the physical reasons of continuous mode conversion numerically.

It becomes obvious that continuous mode conversion complicates the interpretation of sensor data and makes defect detection and localization more difficult. Therefore, the findings in this part of the book may also help to design structural health monitoring systems in such a way that continuous mode conversion can be avoided.